MICTPCS Resource Allocation System

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By

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ABSTRACT

The architecture of government buildings built in the pre-modern days did not cater for the recent advanced technologies of the internet via fiber distribution or (unshielded twisted pair cables) UTP in their plans, therefore making it a bottleneck for the modern network technician installers to plan for clear routes within the buildings for the internet connections and resources being allocated to the diverse ministries. This problem also affected remote located sites of the MICTPSC. A feasibility study was carried out to determine if it was viable to carry on with the research study and it showed that it was economically, technically, social and operationally feasible to continue. Research instruments used in the study included interviews and questionnaires which all contributed to the in house system development. From the research the developer came up with objectives to counter the identified weaknesses. To fulfil the objectives and aims of the system the following instruments and methods were used. The system was coded in PHP programming language with MySQL being used as a database server and all necessary forms were created using Microsoft Dreamweaver within the implementation phase. Tests were carried out during the development of the application to effectively validate and verify the performance of the system. Maintenance strategies were also implemented after using the pilot changeover method in implementing the system. The system met all the objectives that had been stated within the initial development stage, thus the Resource allocation system easily aligned itself with the organizational objectives and has proved to create a culture of transparency and accountability. Recommendations for further development of the system involved implementing a mobile application for the system.

DECLARATION

I, **Andy T. Maitera,** hereby declare that I am the sole author of this dissertation. I authorize the **Midlands State University** to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature: …… Date: …….

APPROVAL

This dissertation, entitled **"MICTPCS"** by **Andy T. Maitera** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University,** and is approved for its contribution to knowledge and literary presentation.

Supervisor's Signature: …….

Date: …….

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DEDICATION

This research project is dedicated to my family and friends for their loving support throughout

TABLE OF CONTENTS

LIST OF ACRONYMS

MICTPCS	Ministry of Information Technology Postal and Courier Services
CCS	Central Computing Services
RIDM	Research Infrastructure and Development Department
DFD	Data Flow Diagram
EER	Enhanced Entity Relationship
SLDC	Software Development Life Cycle
GPS	Global Positioning System
UML	Unified Modelling Language
PHP	Hypertext Pre-processor
ROI	Returns on Investment
IT	Information Technology
RAS	Resource Allocation System

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Chapter 1: Introduction

1.1 Introduction

Today, projects are more complex than ever before. Thousands of tasks must be precisely controlled within the stipulated budget and time. The completion of a project requires the judicious scheduling and allocation of available resources. Nevertheless, if time schedules and cost budgets are to be met, the work must be supplied with the necessary human resources, equipment, and materials when needed on the job site. Overally, the resource allocation system achieved the desired outcomes whilst increasing effectiveness, efficiency of the existing system. This chapter elaborated the background of the organisation, problem definition of the existing system, anticipated objectives, clarifying with emphasis on the instruments and methods then conclusively justifying the realistic aspects of developing the resources allocation system of the MICTPCS.

1.2 Background of the study

Background of the study is a collection of adequate information recognized within analysis of the proposed argument or problem with the relevant steps up to the designing phase till the implementation of realistic solutions (Glover and Richard,2012). One of the major challenges faced by the MICTPCS research and infrastructure department was the high gap in resources allocation conditions between populations living in different geographic areas. The evidence clearly suggested that the incremental approach of allocating information and technology resources from centre to local levels was one of the factors influencing the widespread inequity in the ICT productivity and efficiency status according to the information gathered from the research methodologies through interviews, questionnaires and observations as indicated within the design phase.

To improve efficiency, accountability and transparency in the MICTPCS, the researchers advocated for a ‘needs-based system’ which provides clear network diagrams of the existing sites with the allocated resources. The ministry recently embarked on major projects such as the development of the ICT industry especially for the underdeveloped communities by the use of the CIC’s (community information centres) whereby the recently used post offices where changed to be CIC’s offices providing service as that of internet café’s nationally. The project contributes to one of the many which need efficient, effectiveness with resource planning and allocation so as to increase productivity with the resources being distributed transparently with

accountability. The primary objective of the study involved designing an information architecture for integrating information from a local host destination whilst remotely controlled. The solution helped the administrators, technicians at large in making responsive decisions from the integrated information.

1.2.1 Background of the organisation

MICTPCS was first established under the treasury bureau the ministry of finance whereby all its functions worked under this ministry as a sub department called CCS (Central Computing Services) up until in the year 2008 it was separated to operate on its own without merging up with its parent ministry. The MICTPCS comprises of six departments and the main headquarters is located in Harare at the Reserve Bank Building. Sub branches are scattered all over Zimbabwe at each Government complex whereby remote system engineers would be working, coordinating with the other groups in cases of network failure.

1.2.2 Organisational structure

Robbins (2013) defined the organisational structure as a combination of rights, duties with prescribed authority, communication and coordination within an organization. The following top to down organogram illustrates the structure of the MICTPCS in figure 1.1:

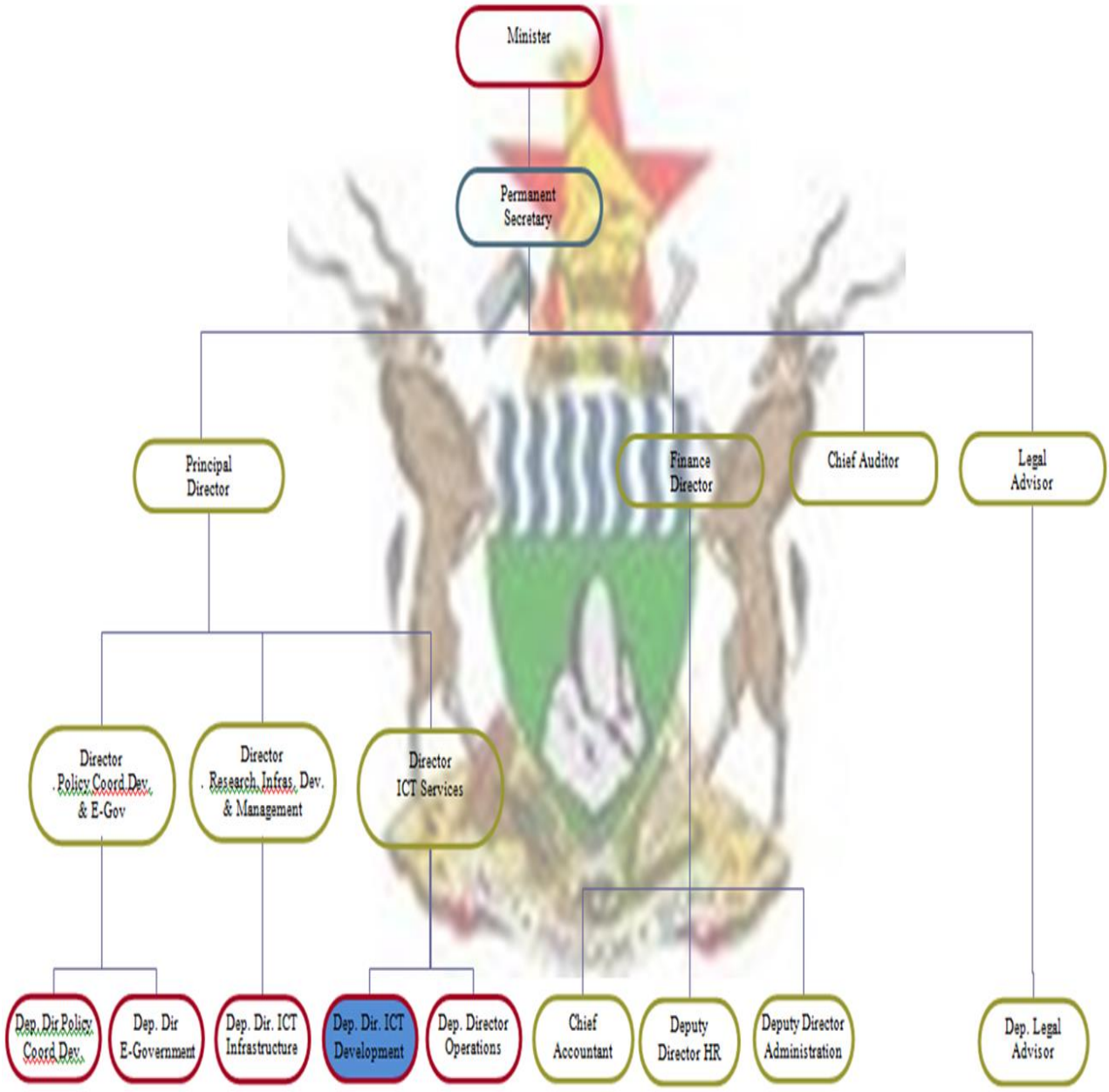

Figure 1.1: MICTPCS organisational structure

1.2.3 Vision

A vision is a brief statement which defines the futuristic destination were the organization seeks to be in outlook (Stamper and Jillian,2017). The vision of the MICTPCS encompass the establishment of a knowledge centred society with universal connection links by 2020.

1.2.4 Mission statement

This is a brief written statement by the organization with the purpose and primary objectives designed to encapsulate its present operations (Stamper and Jillian,2017).

The MICTPCS's mission involves the exploitation of prospective MICTPCS's viable socio-economic expansion in Zimbabwe.

1.3 Problem definition

According to Jillian (2017), this is a seemingly a gap between the current state and the desired state, or simply the deviation of the norm. The architecture of government buildings built in the pre-modern days did not cater for the recent advanced technologies of the internet via fiber distribution or UTP (unshielded twisted pair cables) in their plans, therefore making it a bottleneck for the modern network technician installers to plan for clear routes within the buildings for the internet connections and resources being allocated to the diverse ministries. This problem also affected remote located sites of the MICTPSC. In addition, this contributed to the following problems depicted below:

- Lack of site maps for the resources within the MICTPCS led to poor transparency and accountability of the resources in diverse network site leading to poor tracking and monitoring of resources.
- Lack of proper resource lifecycle status (whether being dumped, new or used) during its timeline of functionality led to obsolete resources being used without any replacements resulting in poor inefficient service delivery by the MICTPCS.
- High rate of data redundancy and Inconsistency was a major cause of concern since there were no repetition check as with the computerised resource allocation system.
- The duplication of the information of the resources led to time consuming and high rate of wastage (stationary costs, transport cost).
- Data was only being accessed by one employee at a time. This was time-consuming. Hence, this led to the business being unproductive.
- Risk of the data and crucial information being destroyed in case of a natural disasters or depreciation.

1.4 Aim

Paul (2013), defined it as the main goal an organisation wants to achieve and add value within a particular period or season. The aim of the MICTPCS ~RAS study involved:

- Designing an online web based system which provided up-to-date real time transaction processing, resource allocation, generation of reports and site survey within the LAN,

WAN and MAN whilst helping the organisation to conquer the complexity in tracking all the resource of the organisation distributed in diverse geographical network sites.

1.5 Objectives

Eliza (2016) states that an objective is a comprehensive picture of the steps undertaken within a stipulated plan in order to achieve the prescribed aim.

Based on the plan of the system the following objectives were put forward by the researcher to:

- Enable remote allocation of resource, transfers, and reduced transport costs.
- Perform and show age analysis of the resources available in the organisation and determine the life cycle of the product.
- Enable generation of real time activity logs, reports and notifications of any data manipulation by the system users.
- Enable navigation of the network sites within the LAN, WAN, and MAN by the system users in an instance of network failure.
- Allow top management to assign the status of the resources whether to be repaired, damaged or used through confirmation reports.
- Enable repetition checks and prevent the duplication of resources information available.

1.6 Instruments and methods

Instruments

These are products or tools with the capability to measure the performance, diagnose errors and trace the information when needed ,(Dempsey,2017).To fulfil the objectives and aims of the system the following instruments and methods were used:

MySQL: This is a back-end multi-standard platform for maintaining stored data (Beighley and Morrison, 2008).

MySQL is the ideal database solution for the following reasons:

- It is easy to use and therefore the project team will not face challenges in creating a database that the system will use.
- It can be downloaded for free as it is an open source software and so no monetary costs will be incurred by the organisation to acquire the software.
- It can hold large amounts of data and that will be useful in the system to be developed. (Vigneshpalani, 2010).

PHP: This is multi-purpose server sided script programming language for web development, (Vigneshpalani, 2010).

XAMPP – open source software for hosting web-based applications that is free and user-friendly developed by the Apache team .as it comes with many support documentation and guides(www.apachefriends.org,2016).

Methods

Waterfall System Development Method: It is the model which is going to be used due to the its incremental approach allowing agility to the system software.

Data gathering techniques

The researcher used the interviews, observations and meetings to perform a thorough data gathering analysis. Interviews played a major role in gathering information related to the manual procedures which were being undertaken at the organisation and were implemented within the development of the information system. Questionnaires were also of great importance in conducting the research as they were cost effective and were familiar to quite a number of people thus more people were obligated to respond. These techniques advocated for the primary sources of data.

The secondary sources helped the researcher and project team with interpretations, discussions as commentaries of the primary sources.

1.7 Justification and rationale

This is the organisational delineation of how the project's task will meet the goals whilst explaining the step by step functioning of the project (Borrington. K,2013).

The resource allocation system eradicated all the problems defined above as the system's benefits comprise of:

- Enabled tracking system for the allocated resources
- Allowed decision making focus rather than compilation of records and information.
- Easy notifications, reporting for the system users.
- Morale boost for the employees due to the reduced workload
- Enabled view of the status of the resources available.
- Better-quality efficient data security controls
- Reduced costs of paperwork easy communication link between organisational stakeholder.
- Enhanced data storage, effective retrieval with efficient flow of activities.

1.8 Conclusion

The introduction phase was an instrument in laying the fundamentals of the study by elaborating the background of the study, problem definition, aims, objectives of the study and its significance to the organisation showing a brief summary of the problem and implemented strategic solutions. This paved way for the planning phase in the bid of checking the feasibility of the project.

Chapter 2: Planning phase

2.1 Introduction

The planning phase is defined as a focus on the project activities, processes required to ensure the accomplishment of the project management plans until the project terminates whilst refining and elaborating project risk, scope, costs and schedules (Mussbacher, 2009). In this phase the researcher's findings of the reasons for building the system, business value, risk analysis, feasibility analysis which expounded the systems viability and the work plan of the proposed project were the core points of focus.

2.1.1 Reasons for building the system

The subsequent precise details have been emphasized and put forth as measures of building a robust computerized system:

- To enable data security, consistence and reliability through secured, encrypted data stores and application software unlike the manual system in hand
- The to eradicate several counts of human-errors which are occurring.
- To eliminate the communication barrier and promote the exchange of information of interest since there was lack of collaboration with other remote site in terms of resource allocation.
- Easy fault finding in terms of the network failure in diverse site therefore increased efficiency.
- Unnecessary costs will be eliminated since more employees are being employed. The system will eliminate these costs whilst leading to effective and efficient use of the resources especially time, money and human resources.

2.2 Business value

This is defined as an informal term all-encompassing the forms of significance which determine the well-being of the firm futuristically in outlook (www.informedlibrarian.com, 2016).
According to (Luftman et al.,2013) potential business or organizational value encompass the enhancement of the product or service with reduced error rate during its life time.

2.2.1 Employee value

Employee value is a process of knowledge management which involve knowledge creation, sharing, refinement, storage, acquisition, transfer, and utilization by employees within an organization (Hoyos-Gomez,2009).

- The developed system by the researcher and project team provided the "employees knowledge" with the best appropriate way to allocate the resources efficiently and effectively.
- The system enhanced employee discipline by monitoring the resources being allocated thereby reducing the rate of corruption due to the transparency and accountability flow of the information per transaction.
- Lower employee supervision is now being implemented with increased innovation of the system hence increased motivation for the workers and work satisfaction.

2.2.2 Shareholder value

This is a measure of the actual revenue generation created by the organization for its shareholders pre-eminent and the governing corporate management objective (Borrington ,2013). It identifies specific areas which the organization's value is destroyed, created, asset effectiveness and the capital structure.

- The system enhanced the effective communication between the shareholders within different locations or sites whilst reducing the operational costs and asset effectiveness by the efficient expert decision making system which reduced the transport costs for instance.

2.2.3 Organisational value

This is a principle which is regarded as the people driven standard which deal with a specified organisational code of conduct. (Borrington ,2013).

- Reduction of costs, risk, restructuring process from development orientation to service orientation within organisation.
- Reduced default, errors and trend analysis therefore enhance decision making by the top management to attain the stated goals.
- Traceability of the allocated resources within the speculated time whilst showing the status of the resources added the management value.

- easy audit results, asset management and accountability of the resource at hand due to the backup support of the system which reduce the data lose.

2.2.4 Societal value

Societal values are beliefs, principles, assumptions that direct organizations decision-making and actions of the society's best practices (Hoyos-Gomez,2009).

- The best standards and concept of the service such as the ITIL or ISO 20000 frameworks have caused a reduction in costs, improved services standards and guidance

2.3 Feasibility analysis

Thomson, (2013) states that feasibility analysis is defined as an analytical tool which consolidates arguments, recommendation and limitations centred on factual evidence, in the bid of assisting decision makers to determine the viable best alternative and orientation of the proposed project before its implementation. Feasibility study comprise of different processes that are used to analyse the system before its acceptance encompassing, technical, economic, operational and social feasibility which were used to act as the viability checkpoints examinations of the likely success of the system developed.

2.3.1 Technical feasibility

Marakas (2011) defines technical feasibility as a process system analysts search and investigate technical resources required and currently available within the organization to accomplish the project as per user requirements within the specified time and budget. This phase was completed by the system analysts to verify if the system had the technical aspects needed for it to function appropriately whilst taking note of the barriers.

Technical expertise (personal skills required)

The individuals to whom the system was developed for had to encompass the knowledge and skills of how the system functions since they were familiar with SAP and PASTEL therefore there was need for the training. The system users consisted of system administrators, technicians and end users (civil servants in government departments and ministries).

- The system developer was familiar with the instruments used for developing the software PHP, HTML, JavaScript languages and the development platform comprising of Dreamweaver cs3 and the server side MySQL.
- The network technicians within the MICTPCS assisted and lubricated the positive implementation of the resource allocation system to ensure efficiency and effectiveness in cases of network failures.

System maintenance was performed by system engineers and analysts after the implementation stage.

Software specifications

This is an application program used to run a program (Aggarwal ,2003). The software specifications which were available and those acquired are show clearly in table 2.1.

Table 2.1: Software development requirements

Items	Required	Available	Solution
System Software	Windows 10 Microsoft Office Suite 2016 Server R2016 Version	Not Available Not Available Server R2012v	Acquired the software not available
System Development Software	Adobe Suite cs6 PHP MySQL HTML	Present	Used the present software available
Utility Program	Sophos	Present	Used present

Hardware specifications

Aggarwal (2003) defines it as a computer systems physical part. These are the hardware components which were used to develop the system acquired and already available at the MICTPCS.

Table 2.2: Hardware specification requirements

Item	Required	Available	Solution
Ram	16GB	8GB	Acquired the required Ram
Hard Drive	3Tb	500GB	Acquired the required drive
Processor	5GHZ	2.2GHZ	Acquired the required processor
Printer	M605dn	M405dm	Acquired the required printer
Core Switch /Router(2960)	2960(48 port)	c2900	Acquired the later router version With more ports
Computer Machines Processor	Core i7	Core i3	Acquired the required computers
Server	2016 Version	2013	Acquired the required server

2.3.2 Economic feasibility

This is the variance between the financial benefits weight against the monetary value of the costs incurred when developing the system (Thompson ,2013).

According to the concept of cost benefit analysis if the costs outweigh the development benefits the project of the system is regarded unworthy and unreliable (Masterman.G ,2012).

Benefits: Financial revenue inflow plays a crucial role in the development of the system software. The benefits comprise of two aspects tangible benefits and non-tangible benefits.

Tangible benefits

WebFinance Inc. (2014) defined tangible benefits as that revenue which can be quantified in monetary value realized by the organization.

Tangible benefits comprise of:

- Increased efficient allocation of resources with reduced cost of paperwork and delays.
- Reduced labour costs and audit checks.

Intangible benefits

In-tangible benefits are difficult to measure and expression into monetary value (WebFinance Inc., 2014). Intangible benefits comprise of:

- Improved total quality information of the decision making trends.
- Increased goodwill for the MICTPCS stakeholders from donors due to transparent statistics of resources.

Table 2.3 presence a cross analysis of costs and benefits of the prospective resource allocation system implemented.

Table 2.3 Benefits

Item	**2016 US($)**	**2017 US($)**	**Value US($)**
Intangible Benefits			
Error reduction	16000	8000	8000
Processing time decreased	6000	7500	3500
Costs saving	20000	10000	10000
Productivity improvement	5000	12000	5000
Reduction in recruitment	20000	14000	6000
Hosting the web	12000	7500	4500
Stakeholder loyalty increased	6000	12000	4000
Increased productivity	3500	16500	13000

Tangible Benefits			
Paper work reduced	8000	6000	2000
Reduced operational cost	12000	10000	2000
Reduced labour cost	12000	8000	4000
Total			**62000**

Table 2.4 Development costs

Item	**Quantity**	**Amount**
System software	1	200
HP Machines(users)	3	3200
Windows Server 2016	1	1200
Database Server	1	1300
Sophos Antivirus	1	90
Application software's	1	270
Printer	1	500
Core Switch/router (2960)	1	3550
Total		**17100**

Table 2.5 Operational costs

Costs	**Amount ($)**
System maintenance	3400
Additional computer cost	500
Sundry computer overheads	1200
Hardware maintenance	400
Setup cost**(**Staff training, ancillaries**)**	2000
Total	**7500**

Table 2.6 Cost Benefit Analysis

Item	**Amount**
Total benefits	**62000**
Total costs	**24600**
Excess of benefits over costs	**37400**

From the above results, it is worth implementing the project since the benefits outweigh the costs.

Return on Investment

According to Randall (2011) this measures the efficiency of the project. The calculation is calculated below by dividing the benefit and expressing the result as a percentage.

Return on investment = (total benefit -total cost)/total cost *100%

=62000-24600

=37400/24600 *100%=152.0325%

152.0325%

A positive on the return on investment reflects the reliability and viability of the project. The result states that for every dollar invested $1.52 will be given back. Therefore, the return on investment for the system was viable for its implementation.

Payback period:

This is the amount of time taken by a project to recoup its initial investment and start experiencing profits project (Jan, 2013).

This concept focus on the aspect of shorter payback more favourable returns as illustrated below by the researcher.

Table 2.7 Payback Period

Year	Cash flow	Cumulative cash flows
0	(25000)	(25000)
1	18000	(7000)
2	20000	13000

Payback period =1year +(7000/20000) months

= I year 4 months

The calculation above shows that the initial investment w settled after one and a half years. Therefore, the project is worth implementation compared to the future benefits of revenue inflow.

Overview

The economic feasibility analysis of the particular project in conclusion affirmed to be worth of implementation because of a shorter payback period and a positive return on investment result for the resource allocation system.

2.3.3 Social feasibility

Social feasibility is a detailed study on how one interact with others within a system or an organization (Berrie ,2008). This phase was undertaken to verify if the internal stakeholders and external stakeholder such as the donors would acknowledge the innovative initiative of computerization of the resource allocation system. The social norms, values and attitudes were looked into even though there was resistance to change which affected other stakeholders. Therefore, a thorough assessment was undertaken by the researcher and project team for the socio-impact of the new developed system taking note of the stakeholders involved.

Top management

All the administrative work was eased up by the exploitation of the system. The management have all the security privileges to allow the smooth flow of the daily operations of the organization, guarantee being certain. This created the needed connection from the stakeholders. The innovative technology impressed the management team which gave a positive response towards the system. Therefore, the prospective system was feasible towards the top management.

Employees (records department)

The introduction of the new system ironically depicted reduction in workload especially within the organization for the employees. However, the records department retrenched two of staff members. Therefore, the system was not socially acceptable in light of the fact that the employees were retrenched.

Technical

The workload and site survey was reduced especially in terms of any network failure. Site location are now easily identified with correct resource co-ordinates. The technicians had the light blazing to them therefore the system was socially feasible.

Donors

This allowed the external stakeholder to verify and assess the specific records of the resources allocated remotely and locally for later investment and safe record keeping. According, to the donors the system was socially feasible.

Overview

Basing from the analysis carried out, the system was viable due to the reduced training costs and workload making it socially feasible.

2.3.4 Operational feasibility

Operational feasibility is the degree level which answers the "how part" of the proposed system transparency and accountability in solving the current problem, relative to the prospects identified in the course of problem definition (Skidmore and Steve (2013). Operational feasibility reviews the willingness of the organization to support the proposed system.

Top management

All the strategic goals were implemented from the top management. Failure or success of the project is determined by these strategic decisions. The system developed was initially launched and backed by a proposition from the top management. Therefore, the commitment of the management towards the project lead it to be a success story within the MICTPCS.

Technicians

Bottom line workers partake a crucial role in the success of an organization. According to the specification of the system they accepted the implementation basing on the resources allocation system's timely**,** pertinent accurate functionality whilst reducing their workload

System Users: Administrators and Records department

The system was implemented, tested and functioned correctly therefore according to the SU it was operationally feasible.

Regulations

The standards were set according to UTIL therefore this was a guide-line to the operations of the system enhancing its operational feasibility.

Training

- The training was conducted at a workshop for all the stakeholders involved in the system specifying all the necessary operations. User manuals were added advantage during the workshop.

2.4 Risk analysis

Is the process of identifying, assessing and addressing risk as well as reviewing and reporting it(Bohdalova,2007). According to the Bohdalova, (2007) also state that the identification of risk comprises of two major specific processes which are;

i. Commissioning risk review: involve specific selected individuals or groups of individuals who are accountable to observe the major operations of the organization's which could be at risk.

ii. Risk Self-assessment: this is whereby each department verifies its operations and identify what could be the risk contributing factors, which the output result would be managed by the MICTPCS.

Based on the identification phase the researcher implemented the commissioning risk review process and the results are shown in table 1 below.

Table 2.8 Risk analysis

Risk	Probability of Occurrence	Impact	Precautionary Measure
Economic Risk Because of the level of instability the country there is a risk that the project may fall beyond the budget	Very low given the availability of almost all material resources needed.	High	☞ The project finances should release funds as soon as they are needed. ☞ Also make sure that all materials are in order.
Technical Risk ▪ Virus attacks ▪ Network failure ▪ PC failure	Medium because of the degree of virus proliferation	Potentially High	☞ All Antivirus software should be updated ☞ Backup of the system during development should be enforced.
Operational Risk ▪ Users are likely to resist the system since such systems are not common. ▪ They might not have confidence in a locally developed software	Low	Low	☞ Make sure that users are involved during the development of the system. ☞ Training should also be done in a friendly atmosphere.

2.4.1 External risks

An external risk is a likely occurrence or event which can't be monitored or alleviated by the business itself. This can be in form of natural disasters or human action like burglary.

Burglary: This involve enforcing physical entry into a prohibited arena or violating intellectual property. As a precautionary measure burglary locks, surveillance cameras and sensors were implemented into the premises of the organisation were data is stored.

Natural disasters: These are unprecedented event occurrences such as earthquakes and floods which cannot be controlled by anyone. The use of third part backups will aid up when such occurrences are experienced.

2.4.2 Risk planning

(Bohdalova,2007), came up with five strategies to plan for when avoiding. mitigating, transferring and accepting the risk basing on the condition and its level of risk. The analyst chose the best ideologies by applying the effect defective controls and the treat aspect so as to reduce the risk of the resource allocation system. The other aspects are defined below:

- **Tolerate** – not to partake any action but just tolerate if it is within risk appetite,
- **Treat** – take actions meant to reduce the impact of risk to be on acceptable levels,
- **Transfe**r –transfer someone willing to take care of the risk for example insurance companies, pay premiums and third parties,
- **Terminate** – dismiss all operations that provide unacceptable levels of risk.,
- **Effect defective controls** – measures put in place to decrease the risk so that operations are performed in an appropriate way (Bohdalova,2007).

2.5 Stakeholder analysis

This is a systematic process of gathering and analysing qualitative data whilst taking into account the interested parties involved during the development and implementation phase of the services (Osborne. R ,2011). The analyst played a crucial role in identifying the key actors whilst assessing the alliances between the managers and policymakers acting as a mechanism to prevent potential mis-apprehension.

The stakeholders involved in the resources allocation system comprised of the records department, top management, technicians and administrators comprising of system operators.

Records department

Records department were interested in policy implementation of the resources records whilst allocating the resources accordingly to the specified sites. The records department have the administrator's access level therefore, giving access level right to the users.

Technicians

The technicians are responsible for repairing and dumping the resource if assigned a task by the system administrators. Therefore, accountability and transparency of the duties to the

technicians is easily managed by the administrators. Their interest involves the reduction of work and tasks in case of network failure the site location will provided therefore, reducing hustles of tracing the network fault.

Administrators

They are interested in managing the system operators, delegation of tasks to the technicians and viewing the user, system notifications. The system provides administrative rights to the administrators therefore they are expected to manage the system efficiently and effectively.

Top management

There main interest was on archival of the best results by releasing the funds for the system development in return for positive results.

Project team: To deliver the user specifications of the required functionality of the system at a lower cost of production making the project feasible and user-friendly to the end-users.

2.6 Work plan

The work plan is the keystone document of the goals and objectives of the proposal explicated into a sequence of well-defined tasks, if accomplished, will manifest the proposed project into reality (McFarlin,2012).

The waterfall methodology was the guiding aspect in respect of the flow of the project sequence in execution phases as elaborated below:

Project proposal

Planning

Analysis **Execution sequence**

Design

Implementation

After the resource allocation system surpassed the feasibility phase a work plan was put in place generally outlying the schedules to be conducted during the course of the project's life time by the aid of a Gantt chart which is given in detail in table 2.9 and the work plan in table 2.8.

Table 2. 8: time schedule work plan

Id	Phase	Date of Initiation	Date of Completion	Duration (Weeks)
I.	Project proposal	21-12-16	3-1-17	1
II.	Planning phase	5-1-17	19-01-17	2
III.	Analysis	21-02-17	18-03-17	4
IV.	Design	22-3-17	20-04-17	4
V.	Implementation	22-4-17	4-5-17	11++
VI.	Maintenance	4-5-17	On-Going	11++
VII.	Documentation	21-12-16	On-Going	12++

This elucidated the start and finishing date of the terminal elements bringing up a summary of elements via dependency relationships activities overtime duration work.

A Gantt Chart is an evaluation, monitoring technique which checks project life cycle development (McFarlin,2012).

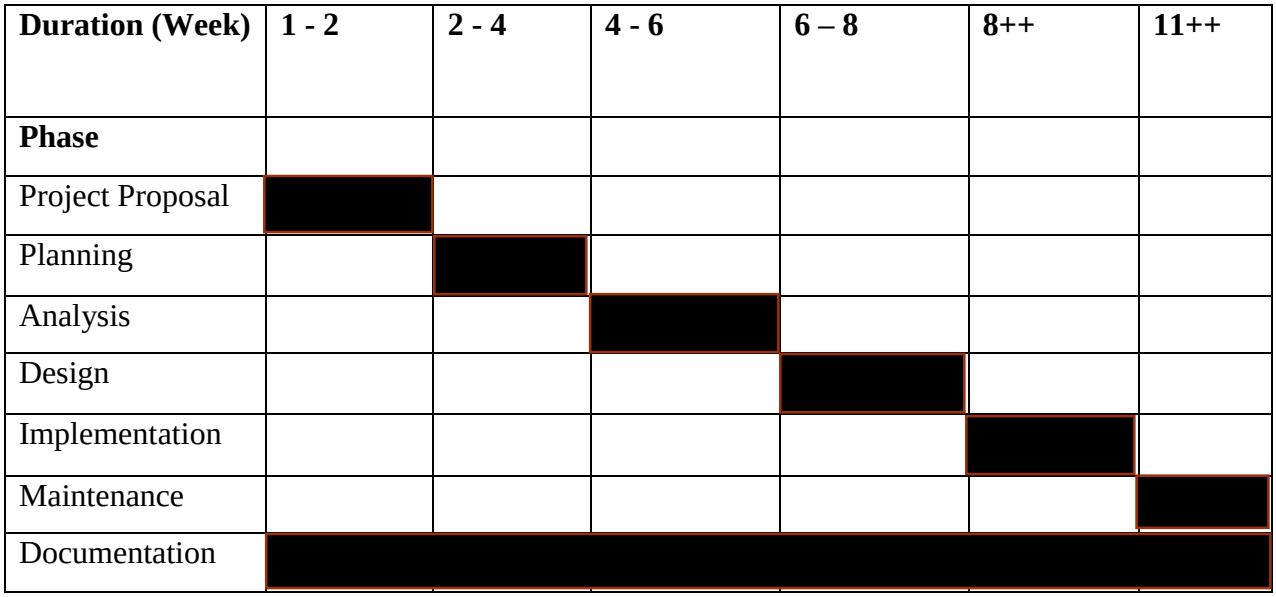

Figure 2.1: Gantt chart

2.6 Conclusion

Conclusive all the pre-requirements of the planning phase have been stated and addressed giving a positive outcome of the project feasibility, schedule and risks mitigation strategies involved. To seal the Chinese, wall the developer will now focus on the analysis stage in gathering the data.

Chapter 3: Analysis phase

3.1 Introduction

Analysis phase is the understanding of user oriented problem which the developed system pursues to resolve by identifying user requirements completely in unambiguous fashion, (Pressman,2013). System analysis involves deep exploration of the current problems of the system by gathering reliable facts and appropriate implementation solutions towards the problems found. This chapter will give an assessment and evaluation basing on the acquired facts and data.

This chapter encompasses the analysis of the MICTPCS~RAS by highlighting the methodologies of gathering data performed by the analyst comprising of interviews, questionnaires and observations. The diagrammatic representation of the case diagram, flow chart gave an enhanced incite of the existing system. The weaknesses of the existing system were unveiled with the alternatives provided which assisted the development team to come up with a blueprint of the developed resource allocation system.

3.2 Information gathering methodologies

This is the fine tuning activity which contribute to the knowledge being acquired and used by the system designer to come up with fully moulded system (Beck and Cummington,1999). The primary data collected was used as the basis for user requirements specification and request for quotations The analyst found the following methodologies convenient and useful in searching the information of interest to be used in the development of the system, to mention;

- Interviews
- Observation
- Questionnaires

3.2.1 Interviews

According to Denscombe (2007) interviews are open-ended conversation focusing to attain the most sophisticated details concerning certain matters from the interviewee. These are face to face dialogues that were conducted between the analyst and the respondents, in which facts or statements were recorded (Modell,2007). Interviews are subdivided into two categories, structured and unstructured interviews. The interviewee used both types of the interviews to come up with the best information gathered.

The analyst was very selective of the type of interview type to be used in each diverse situation. The administrators and top management clearly defined the tasks, background functions of the organisation how the resources were allocated with previous adhoc systems barriers which were faced and recommendations for the developed system.

As of the system users not administrator's information was gathered basing on the reduction of the workload for the developed automated system with a user –friendly interface. From all the interviews, vibrant useful information was obtained though they were limitation factors which incurred in association with the interview under. The following advantages and disadvantages give further outlines the hints towards the use of the qualitative use of the semi-structured interviews.

Advantages of interviews

- The response time was instantaneous from the respondents hence acquisition of the sophisticated answers was made easy due to the privacy of the face to face interviews.
- First-hand information was obtained from the both the top management and bottom line workers therefore the problems were defined and mechanism devised by the analyst were drafted aside.
- The interview was aided by the use of non-verbal expressions which depicted the true reflection for the analyst to note if the conversation was yielding fruitful results to be continued.
- Unplanned questions had clear and clarified responses from the respondents
- Confidence was boosted to the side of the analyst due to the interaction with the top management.

Disadvantages of interviews

The drawbacks which were drawn from the interviews are noted as follows:

- A lot of misunderstanding took most of the time of the analyst in explaining and elaborating the areas of misunderstanding.
- Time consumed in the planning and structuring for the questions for interview took a lot of time.
- The analyst had to monitor constantly the direction of the flow of the interview.
- Venue for contacting the meeting was a delinquent
- Reluctance with the information was another major setback since some of the information was considered confidential not to be let out to external holders.

Interview plan

The plan was used for conducting the interviews by the analyst as summarized below:

Table 3.1: Interview plan

Activity	Description	Estimated Duration
Prepare set of questions	▪ The question for structured interview	-40 minutes
Familiarize with environment	▪ Platform as well as clients (building report)	-10 minutes
First interview with the bottom line workers.	▪ Structured interview	-40 minutes
Second interview with administrators.	▪ Unstructured interview	-50 minutes

Results from interview

This was a taunting task that required a lot of patience and determination inconsideration of the fact that the analyst had to interact with the management and the staff of the organization whilst they were busy with their daily workloads from time after time. It took an approximation of three weeks to assemble valuable vital information since the geographical location of the respondents were centred differently.

Findings from the interview

- Weaknesses of the existing system
- Diverse entities
- Manual processes carried out

3.2.2 Questionnaires

This approach involves drafting of questionnaires and issuing them out to the users of the system who comprise the employees, clients and management the aim being to find information about the current systems weaknesses and their views so that it can be all incorporated into proposed system (Kendall and Kendall,2002). This methodology gave the analyst the opportunity to study the behaviour and belief of the existing system user affected by the system.

Questionnaires were structured and meant for the stakeholders with the mandate of gathering qualitative data whilst bringing out the problems defined overview as shown in the appendix section.

Advantages of questionnaires

- Questionnaires are very economical they created a conducive atmosphere for the analyst by reducing logistical costs of travelling via the use of the effective and efficient means of emails over the internet. Therefore, the geographical barrier was uplifted resulting in reduced analysis of the project workflow schedule in hand.
- They allow the analyst to collect more data within a short space of time with possible respondents to answer the question due to easy dissemination and compilation of the information.
- They are analysed objectively compared to other methodologies.
- Less subtle to biases due to the fact of questions specifically asked by the analyst
- Allowed more privacy and anonymity for sensitive topics such as legal status.

Disadvantages of questionnaires

- Lack of probing of the additional information based on assumptions of completeness with the prescribed questionnaires affected the respondent's analysis of information in coming up with misunderstood responses.
- Lack of further explanations., this issue contributed to the misunderstanding between the questions being asked and wrong interpretation by the respondent due to unclarified feedback from the interviewer. This lead to in enhanced inefficiencies and ineffectiveness.

Results from questionnaires

- All the main objective answers were acquired
- Large pool of the responses were correct
- The procedure was time consuming and tedious

3.2.3 Observation

This is important information by merely looking around perceiving the system as well the way the users were handling their tasks, (Mellor,2006). Based on the findings the objectives encompassed both the pros and cons which helped the analyst and development team to have a large pool of selection towards the most viable methodology strategically used.

The following presents the advantages and disadvantages:

Advantages of observation

- They provided great assistance where explanation was actually inefficient therefore they were minimalistic respondent errors
- The analyst had the opportunity to see the real existing system being implemented as well as the bulk work load.
- The analyst was able to make comparative analysis between the spoken factors and the actual facts functioning on the ground.
- The process had reduced respondent biases from the respondents since the analyst was the one observing the way the existing system functions.

Disadvantages of observation

- The analyst presence partakes a crucial role, partner members would have portrayed a false impression since they were being observed hence resulting in a one-sided conclusion by the spectators.
- Not all the activities undertaken where observed by the analyst since some took place at random pace.
- Personal concentration affected the observer since attentiveness and focus should be the key aspect.

Results from observations

- The analyst had the opportunity to view how the data was stored, operations of allocating resources manually which were time consuming and lacked central storage repository.
- Entities connections of the current system were observed by the analyst realistically.

Conclusion

From the gathered techniques the interviews were comprehended by the observation since all that was said in the interviews and left out was foreseen in the observation of the research. The questionnaires added up the sensitive anonymous information which the respondents were reluctant to release. Therefore, the results indicated the success of the information gathered since each technique comprehended the others deficiency resulting in complete unambiguous and non-contradicting information.

3.3 Analysis of existed system

The information gathering techniques provided the analyst with the relevant insight into the operations of the existing system the 'how part' by bringing out the way the resources are allocated, delegation of tasks, notifications, activity logs and the resources status. The analyst came to the conclusion, finalizing and ascertained that all operations were manually implemented using the adhoc system.

3.3.1 Description of the existed system

The existed system comprised of the records department as an entity. When resources were supplied the record team would manually record all the resources being taken into the store room before being dispatched to diverse locations. All the verifications were done manually.

After the records department records all the top executives or management would verify then approve the sites to be allocated the resources and the project team to dispatch the resources to diverse sites. Each team dispatching the resources would have a project leader.

After the allocation of the resources the records and accounting team would follow up verifying and auditing the resources dispatched in diverse sites of the government ministries.

When there was an error of a misallocated resource the project team would have to travel again to the specific site then to the actual location of the resource.

The administrators would then start their daily routine work of checking the status of the resources distributed in those locations. In case of network failure when a site's network is down the main team from Harare head office would be the one to facilitate the network failure of the node to rise up again. All the functions are done manually.

3.3.2 Inputs

These are resources which aid to the smooth flow operations of the organisation goals and objectives (Masterman.G,2012).

- **Order form: Information** of the available stock from departments and ministries
- **Allocation form**: information with resources to be allocated and responsible project manager.
- **Audit Assessment form**: Verification of the resources distributed
- **Site Maps Form**: Site network map for network technicians for cabinet findings.

3.3.3 Process

This is the inter-link of diverse sequential connected activities with a desire outcome (Masterman.G,2012).

- **Requisition form verification:** Checks were done by the security officer and the suppliers
- **Requisition form transfer:** The request of resources misplaced.
- **Resource audit check:** Manual check for the obsolete resources

3.3.4 Output

Heldman (2005) asserted that an output measure of effort in form of deliverables when inserted data is acted upon. These indicate the end point of an activity or whole procedure in the system. Currently the processes are as follows.

- **Approved Allocation of resources:** MICTPCS approval to allocate resources.
- **Feedback:** Updates on status of the resource which need replacements.
- **Site survey reports:** Results of the network technicians after a site survey.
- **Reports and notifications:** Allocated sites and ministries reports.

3.4 Process analysis

This is defined as a procedure for the organizing whilst authenticating the arrangement and movement of data through a system routine, policies, and techniques to be implemented within a particular system (Bhattiprolu (2014). The project analyst in the project team assisted with the identification of the processes and sequences of the system activities with an insight of how the proposed computerized system would actually function better off than the existing system.

The iteration and concurrency is clearly elaborated below by the activity diagram figure 3.1, whereby an activity diagram is a graphical representation of activities conditional and parallel describing a logical procedure of events (Janssen, 2013).

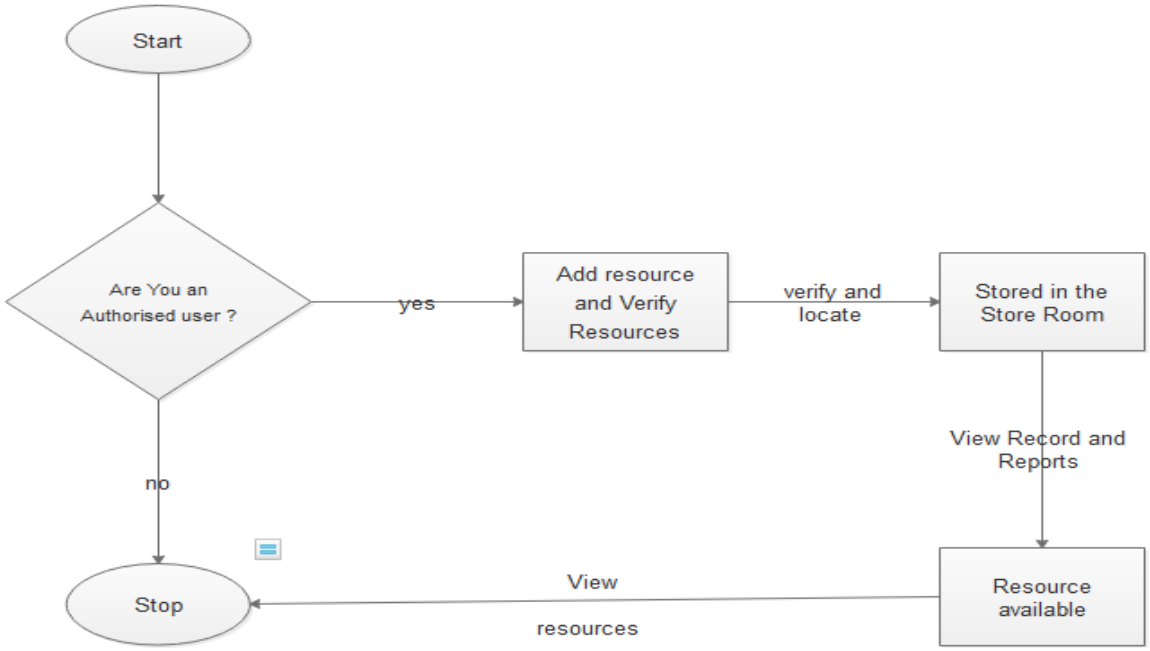

Figure 3.1:Activity diagram for records department

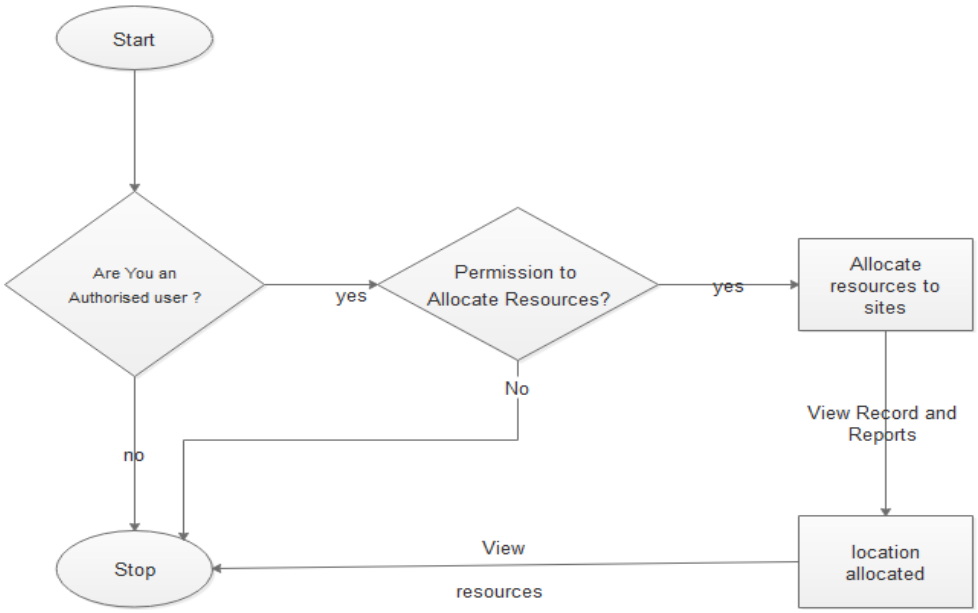

Figure 3.1.2 Activity diagram for administrators

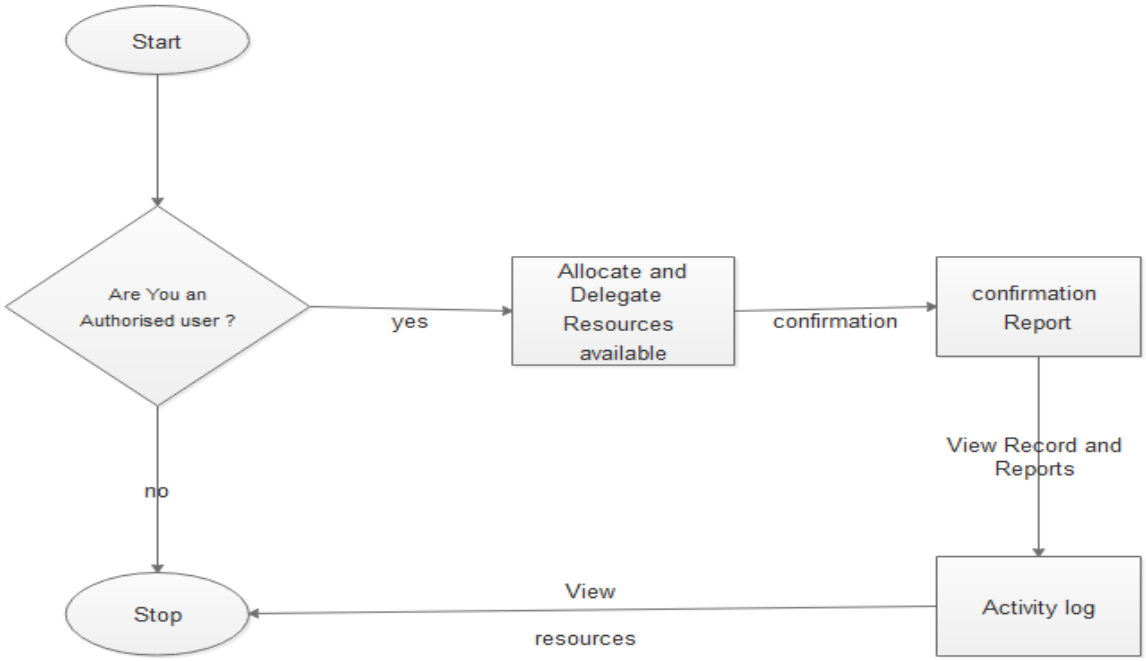

Figure 3.1.3 Activity diagram for top management

3.5 Data analysis

The involves were the analyst would be analysing the data and information patterns needed in the system, storage and data flows within different entities (Shlaer and Mellor,2004). The dataflow diagram and context diagram elaborated whilst illustrating the processes and entities of the organization existing system interaction between the different components.

3.5.1 Context diagram

A context diagram is a process modelling tool which encompasses a single process that denotes the entire existing system scoping systems and process modelling (SmartDraw Software LLC, 2014).

It assisted the project team to clearly define the depth, scope and what was expected of the requirements elicitation phase. The project team, top management, records department team and administrators (system engineers) were the main audience of the project.

The figure 3.2 below depicts how the system is linked or related to the outside world.

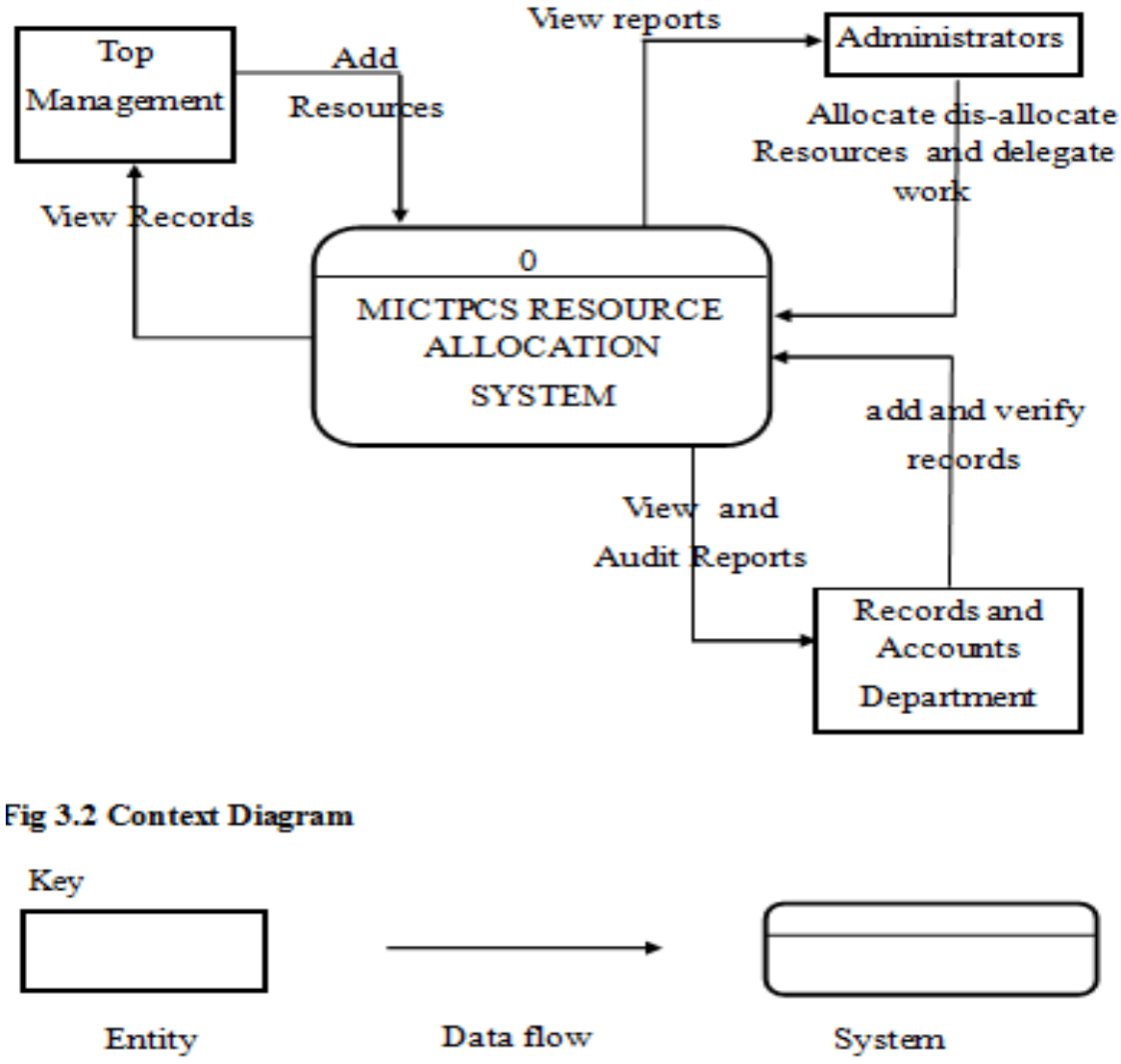

Fig 3.2 Context Diagram

Figure 3.2: Context diagram

3.5.2 Data flow diagram

(SmartDraw Software LLC, 2014) defined a dataflow diagram as a pattern which depicts the flow of information from one process to the next process within the system's components whilst giving a full view of the internal and external functions involved within the system. Figure 3.3 below clearly illustrates the dataflow diagram.

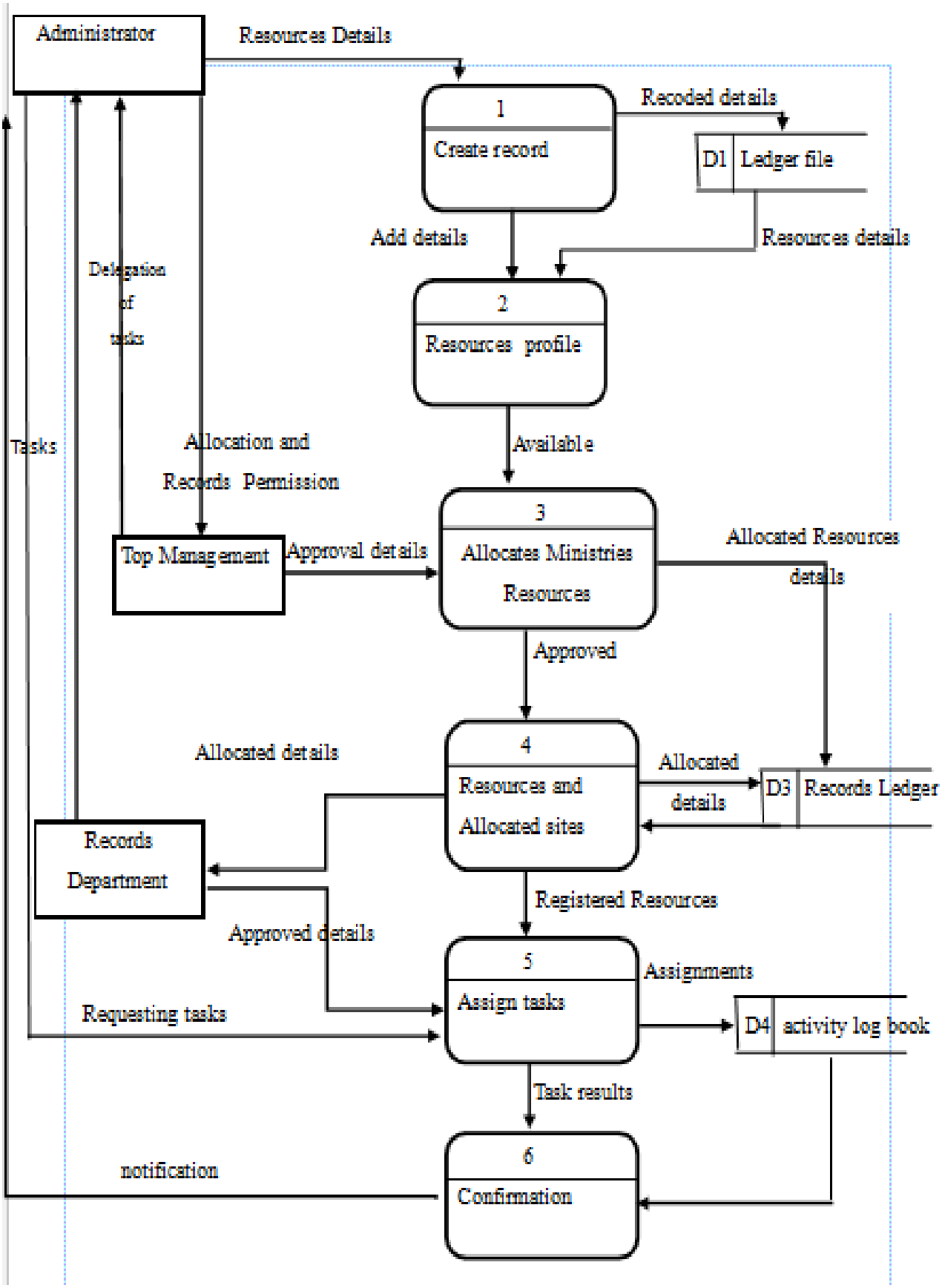

Figure 3.3: Dataflow diagram for the existed system

Conclusion of the data analysis

The main objective of the resource allocation system was computerization of the existing manual system. The data analysis relinquished all the necessary flows of the information and data between system components and the existing processes. The project team had the platform to stencil each and every process necessary to maintain a better platform of the proposed computerized system functionality.

3.6 Weaknesses of the existed system

- It is uncovered that under the current system, resource allocation to various geographic sites were not linked to the relative needs for the remote system. This instance of resource allocation distribution did not guarantee the value of access to administrations for individuals at corresponding needs especially in remote areas.
- Poor accountability, absence of initiative, uncooperative specialists, and high turnover of staff are contrarily influencing the resource allocation pattern and execution of spending plans.
- Pronounced bureaucracy when generating reports.
- Too much involvement of paper work in the allocation of resources leading to the loss of the crucial information.
- Manual allocation lead to self-interest and increased corruption in the distribution of resources
- Lack of resource status level of product's life cycle allocated in remote locations whether being repaired dumped or still in use.

Strengths of the existed system

Although the weakness outweighs the strength the existed system had a relatively cheap setup compared to the computerized system due to the fact of no operations costs of training the users presented on the new system.

3.7 Evaluation of alternatives

Evaluation of alternatives comprises when the available options regarding the development of a system are assessed and the best of them chosen (Kendall and Kendall,2002). After an intensive analysis of the existing system the project team and the research and infrastructure manager came up with a cut-out of alternatives to evaluate the most convenient methodology that would deliver the best outcome of the computerized system before the final say of the decision.

3.7.1 Improvement (Upgrading of the already existing system)

According to (Pressman ,2013) it as an incremental upgrading of the quality of a service or system. This alternative plays a crucial role within a particular organization. The cutting edge of software technology tends to encompass unforeseen rewards whilst taking a lead to profound changes within an organization. To bite the bullet and investigate the existed system the advantage and disadvantages are show and elaborated below:

Advantages

- This choice is of lesser cost it is cheap therefore extra costs, particularly for outsourcing the suppliers, may be kept by the organization for value addition.
- User specifications can be easily met according to the request for quotation.

Disadvantages

- Poorly planned and executed system changes are normally disastrous, with loss of time, customer inconvenience, public relations problems and greater cost being common outcomes.
- Some system problems may not be resolved and posted to be improved.

3.7.2 Outsourcing

This is the platform of identifying the best third party expert to undertake a management, provision of services and administration of system development (Hillary,2007). The organization will have to enter into a contract with an external system developer to handle its needs for the system. This particular option will actually force the organization to release confidential information.

Advantages

- The package provides the required professional training to all the employees using it
- The suite has got a lesser possibility risk of failure since it is thoroughly tested by commercial software engineers and diverse opinions from a wide-range of consumer base making the software as prolific as possible.
- Standardized system will be developed therefore it increased efficiency and effectiveness with reduced biases.

Disadvantages

- The software suites are very expensive to purchase whereby the costs maybe unjustifiable to the institutions budget supplementing. The special training which is a prerequisite to the employees increases the institution costs which it cannot afford.

- General purpose application software packages need to be persistently updated to work efficiently, updates might not always be available due to absence of an internet connection making the whole system insecure.
- User specification might not be met by the supplier therefore resulting in the lack of compatibility of the system as per user specifications.

3.7.3 In-house development

This is when the organization develops the system on its own that it is going to use in its internal operations (Hillary,2007). This will be performed according to the budget and plan of the organization.

Advantages

- Builds more confidents of the developers, it acts as motivating factor.
- The software system can be commercialized therefore resulting increased revenue for the organization.
- Lower cost of production due to the availability the resources which are treated as sunk costs compared to outsourcing the product.
- Manipulation of the system might be easily partaken.
- The system will be standardized according to the specifications of the in-house development.
- The organization will be the sole owners of the product hence attachment of patent rights.

Disadvantages

- It is limited by the budget of the organization's willingness to release into the project.
- There was lack of external stakeholder's support

3.7.4 Conclusion of the alternative selection

From the stated available alternatives, in-house development is analytically viewed as the best since outsourcing and improvement are too expensive. The organization was willing to incur any cost of production as long as the user specifications are met within the system.

Table 3.2: Cost summary of the alternatives

Alternative	Costs ($)
In-house development	15000
Outsourcing	19500
Improvement	16300

3.8. Requirements analysis

Requirements analysis encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product, taking account of the possibly conflicting requirements of the various stakeholders, such as beneficiaries or users (Ramesh and Bhattiprolu,2013). Requirements must be actionable, measurable, testable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design.

3.8.1 Functional requirements

These are intended conduct of the system's operations expressed in the form of tasks services and functions required to perform (Sommerville, 2001). They comprised of:

- Users should request resources in the ministries and departments
- Users should view the resources current available
- Users should perform the delegated tasks
- The system must allocate resource to the specific sites.
- The system must have access levels approved by the administrator giving allowance of the most relevant information to the users.
- The system should have a backup of past records for analysis and decision making prior to the current information available at hand to keep track of the variances analysis of the records of the user's activity log.
- The system should be based on multi-user concurrent users at a time whilst allowing any number of users at a particular moment in time.
- The system should notify the administrator of any changes taking place.
- The system should identify and track the state of the resource whilst giving precise details of the resource in-hand details.
- Keep record of the status of the resource whether being dumped, repaired or new

3.8.1 Use case diagram

This a viable technique used to elaborate the interaction of what the system performs as it accepts the commands from its users (Harris.J,2003). Figure 3.4 illustrate diagrammatically:

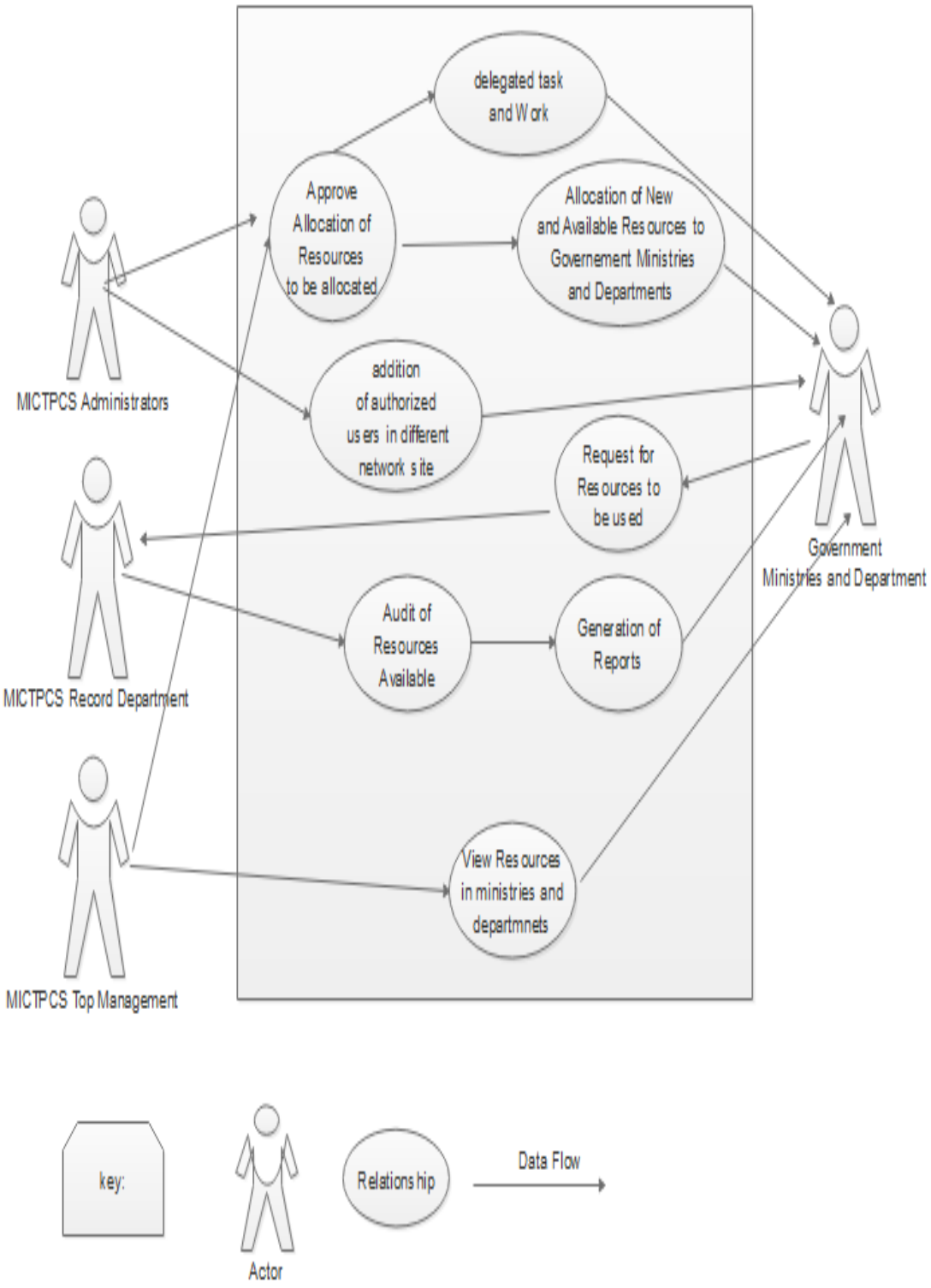

Figure 3.4: Use case diagram for the existed system

3.8.2 Non-Functional requirements

Non-functional requirement involves the software requirement that describes not what the software will do, but how the software will do it being difficult to test and evaluated as subjective (IEEE,2008).

- **Backup**: System administrator will always backup the information and data in case of any system errors and defects
- **Information reliability**: The system provides accurate contents format by clearly elaborating the necessary input and output when there are needed to be executed.
- **Security**: Use of passwords and usernames will work in in line with the access levels.
- **Interface**: The interface amicability or user-friendly to the users will not portray a negative impact towards the user's side.
- **Hardware structure**: The infrastructure was compactible and able to hold retrieve data and information.

3.9 Conclusion

Everything was said observed and analysed in this chapter by giving a clear overview of the existed system's weaknesses and the 'how part' to curb the problems defined by the analyst. Since, lack of proper requirements results in poor architectural designs, consequently low production for the operations of the users. Alternatives were given and the in-house development system was implemented.

Chapter four: Design phase

4.1 Introduction

The main objective of the design phase involved describing the "how part" whilst aligning with the primary objective of meeting and sustaining user requirements. The design phase gets into deeper functions of the design phase comprising of the architectural design, program design, interface design, pseudo code and security design. The consolidation comprises of various components, integrated to maintain proper work flow operations within the organization.

4.2 System design

(Epping ,2001) defines system design as a holistic approach of user specifications that produce a visibly elaborated form of architecture, modules, components, interfaces from the gathered information techniques within the analysis phase whilst giving a clear blueprint explanation of the question and answer of how the system works.

The proposed resource allocation system should be flexible whilst dealing with end user requirements and conditions in an efficient, reliable, effective, maintainable manner at the same time delivering robust security mechanism of the resource allocation system. The participants comprise of business analysts, developers, system engineers, network technicians and database administrator from the Ministry of ICTPCS.

Maintenance:

This is the correct alterations of the services and software products in the bid of error handling to improve the quality performance and its attributes (Pigoski and Thomas,2012). The maintenance team in the project team would be the one responsible for implementing and testing the service. On a management level the system users will be aligned with reduction in costs incurred, on the technical side the removal of obsolete capabilities and optimization of the transaction flow.

Reliability:

This is the incremental approach of the performance of the system with a reduced rate of expected data loss (Beizer B, 2008). Lack of defects and system crashes during operations will enhance the performance and reliability of the system whilst eradicating the current problems being encountered. The system's methodology of implementing the system will allow thorough testing therefore, ensuring reliance and reliability to the end users.

Effectiveness

This involves high production returns at low cost of production. According to the feasibility study in the planning phase the system designing proved worth to be implemented at a lower cost with increased efficiency and effectiveness of the daily routine operations of the system.

4.2 Context diagram

A context diagram is a single high level process which depicts relationships with external entities of the system under consideration (Modern analyst media, 2015). The main objective of the context diagram involves the showcasing between the main link of attraction between the system and its stakeholders involved in the resource allocation system for the MICTPCS. The 0 process is the single unit which shows the one process for all activities. The stakeholders comprised of analysts or researchers, system developers, organization's top management, technicians and system engineers. Figure 4.1 clearly illustrates the context diagram:

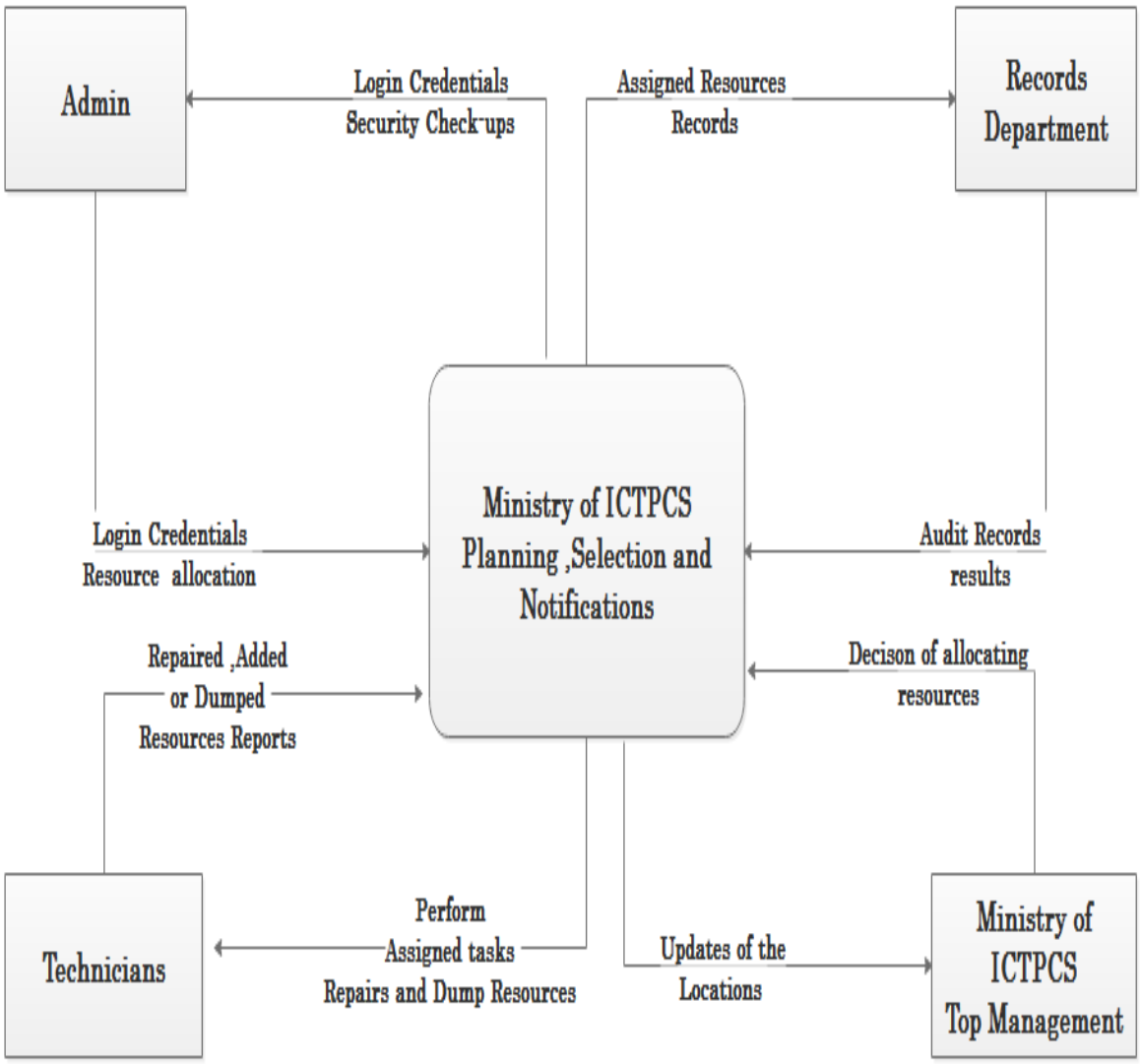

Figure 4.1: Context diagram

4.2.1 Current system dataflow diagram

A data flow diagram (DFD) is a preliminary overview of the actual system being developed graphically representing the flow of information, data through an information system, modelling its processing (Connolly and Begg, 2005). Visualization of data handling or structured design is clearly elaborated making it easier for understanding of the system flow below in the Data Flow Diagram (DFD).

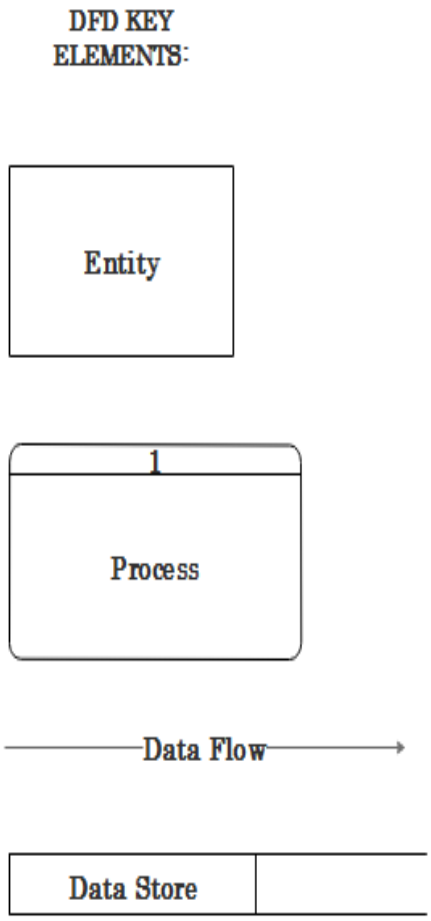

Figure 4.2: Key of current DFD

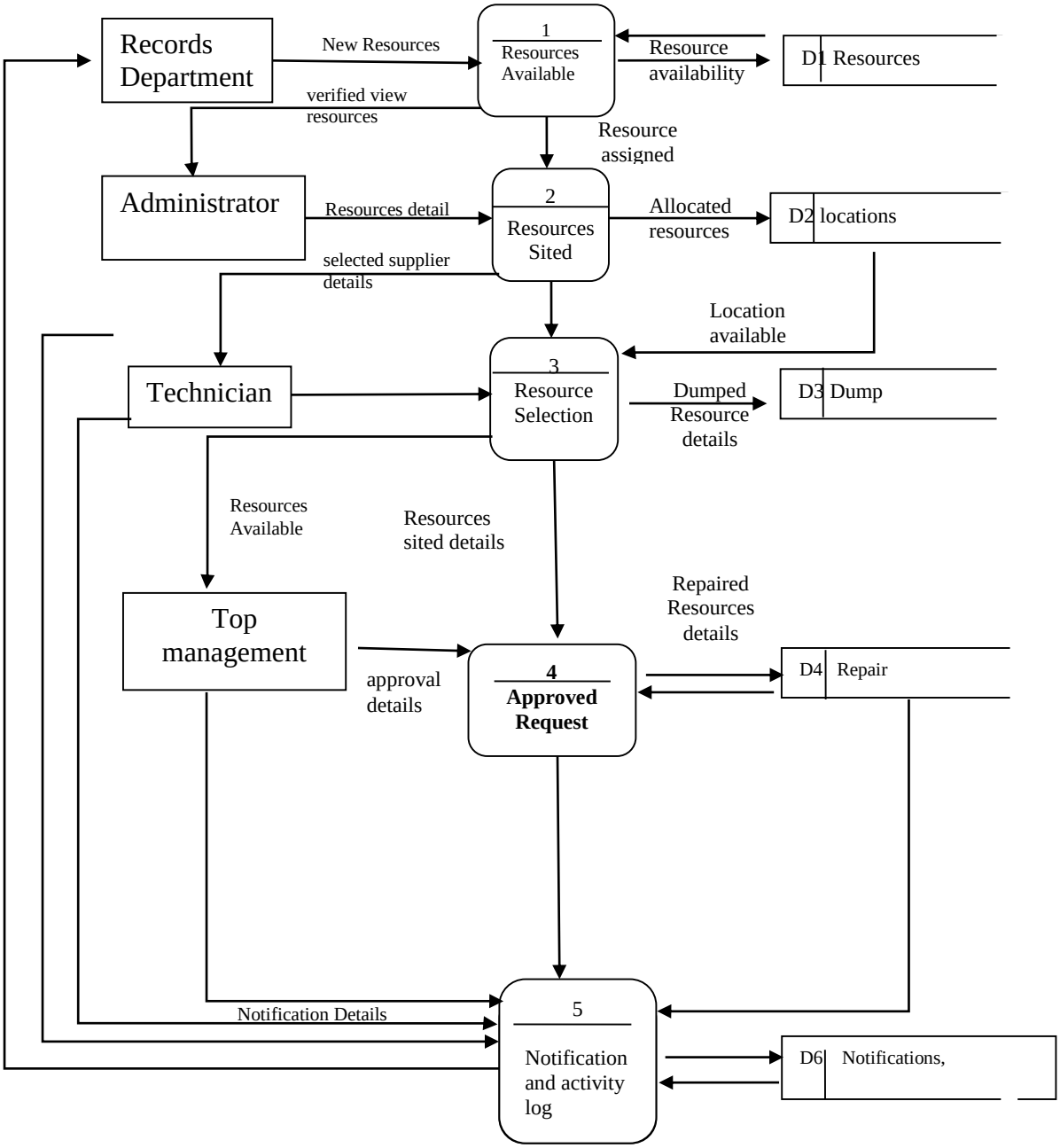

Figure 4.2: DFD of the current system

4.3 Architectural design

This is a creative process which seeks to design a system organization that satisfies functional and non-functional requirements of a system.

The activities within the process depend on the type of system developed, background and experience of system architect and specific requirements for the system (Sommerville,2012).

Architectural pattern

Client-server architecture

The system designer made up a choice by implementing the client server architecture. According to (Sommerville,2012) "in a client–server architecture, the functionality of the system is organized into services, with each service delivered from a separate server whilst the clients are users of these services and access servers to make use of them."

It caters for the accessibility of the information in different remote locations whilst sharing the same database. When virtual servers are in use the implementation of the load can be variable unto the system.

Advantages of the model

- Servers can be geographically distributed across a network physically or virtually.
- General functionality such as printing, reports assignments of services are easily available to all the clients. Therefore, reliability, flexibility and accessible at a lower cost.
- Database backup and updating is easily performed remotely without any intervention or disturbances if a site incurs network failure.

The resource allocation system was organized with a set of services comprising of associated servers, authorized clients or users to the services being offered by the system. The foremost components of the model being:

Server

Print servers for printing services, file servers for file management services and a compilation server, for debugging the system was implemented in the MICTPCS system.

Client

The clients or users would adhere to the services being offered by the server of the resource allocation system when allocating and transacting the resources.

Due to a number of instances of user programs executing concurrently upon different hosts of computers in different network sites.

Networking Cables(UTP) /Fiber connectors

This is the medium used to connect from one link of a LAN, WAN or MAN to another by acting as the backbone within the network topologies of the organisation.

Printers

The notifications and reports of the resources within different sites will be outputted via the printer for further use and verification. Therefore, the printer will be a viable resource within network route.

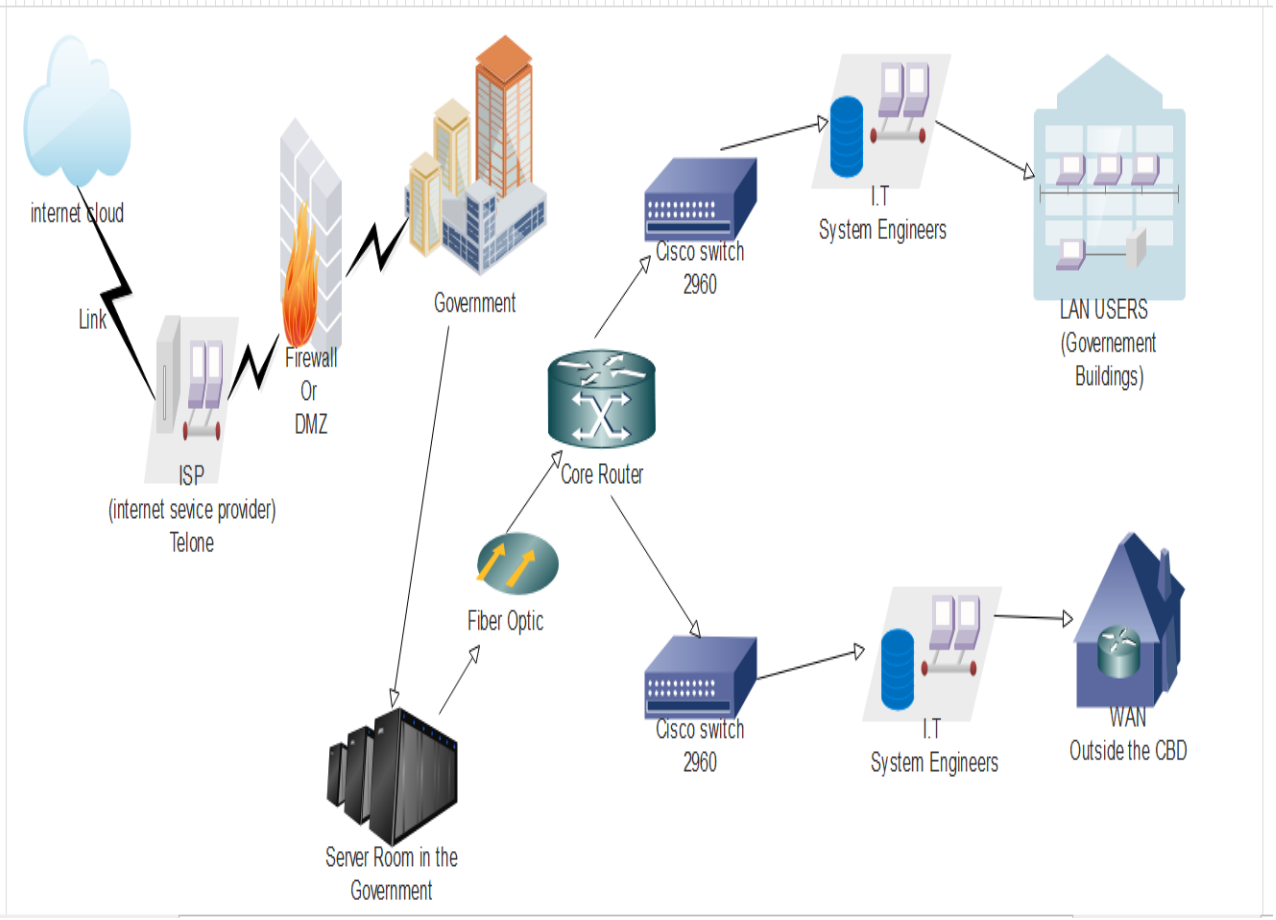

Figure 4.3: Client server architecture

Source:www.edraw.com

4.4 Physical design

This is the transformation of logical abstract of the system into an explicit technical scheme (Coronel, 2007). The design is made up of the software and hardware aspects which focus on the interconnection between the LAN, WAN and MAN devices located in diverse sites with the application software's being implemented and integrated into the resource allocation system.

4.4.1 Router

A router is a device that will be used as a core switch for all the configurations at the main data centres to forward the packets between MICTPCS and remote locations. All vlans and backbone configurations will be performed at the main core router by the system engineers.

4.4.2 Application server

This will be the main data store for the MICTPCS in which all the employees' system administrative details and resources allocated will be saved by the administrators of the system. The servers will be powered by the UPS in case of power failures. This ensures information security, supported real time transactions processing efficiently and safe data storage facility.

4.4.3 Firewall

The firewall or Delimiting Zone (DMZ) will be the main restriction to unauthorised entries within the network between the service providers(Telone) and the client which is the Ministry of ICTPCS for encryption purposes. It is a bridge between LAN, MAN and the WAN networks in securing the application software connectivity within the cloud network.

4.4.4 Client personal computers

The system users will add the resources to be allocated within diverse sites according to their specification area of distribution on the client's personal computers.

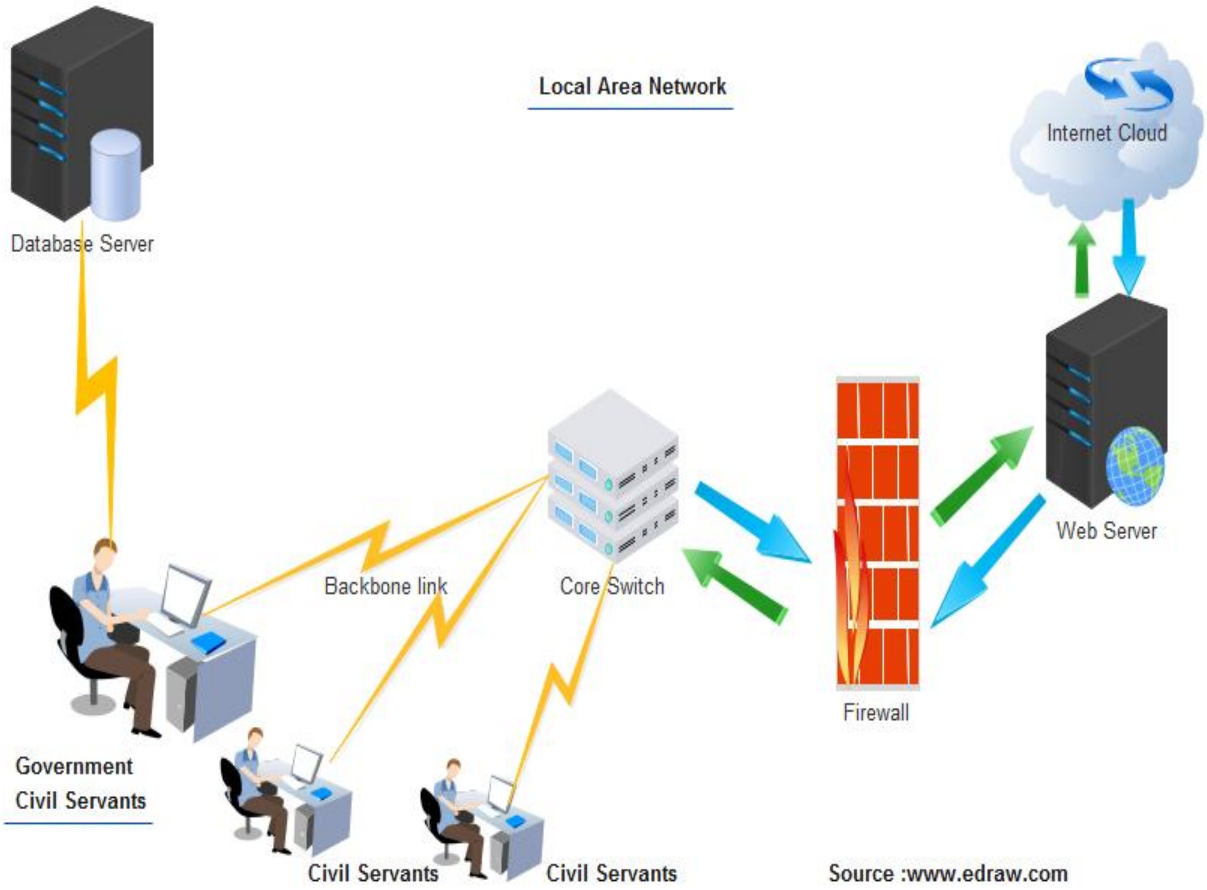

Figure 4.4: Physical design of the current system

Source:www.edraw.com

4.5 Database design

This is the design of data structures and their representation in a database depending on the reuse or creation of a new database schemer (Sommerville,2012). The system analyst undertook certain stages to come up with the proper architecture for the database by implementing the requirements gathering methodologies.

Requirements gathering

- This is a process of collecting information from specific database users to solve the existing information storage problems whilst implementing the necessary expectations to be met by gathering information from potential database users on their expectations (Massol and Husted, 2003).

The subsequent data was gathered from the research analysis:

- Information based on the existing data being stored
- Futuristic business value of the data to be stored in the database.

4.5.1 Data modelling

This process involves the conversion of the business model into a data model that will be used views, tables and other objects that comprise the database (Massol and Husted, 2003).
From the foundation of the database designing process, the analyst defined the actual standing purpose of how the resource allocation system database would function before its commencement.

4.5.2 Database architectural design

This is a process of drafting the rules, processes and specifications that dictate how data is stored in the database and accessed by the components of the system that uses it (Hellerstein, Stonebraker and Hamilton, 2007). The analyst chose the ANSI SPARC which is elaborated and illustrated in three staged platform model in fig 4.4.

4.5.3 ANSI-SPARC three-level architecture

This is an abstract of the DBMS comprising of three levels the external, conceptual and finally the internal level (Jardine and Donald A.,1977). The model seeks to isolate direct user view from the system users allowing user friendly interface.

4.5.4 Internal level

This is the bottommost level which deal with the way data is represented to the users.it shows exactly how the information or data is stored and organised for accessibility within the database (Crocket,2009). It mainly focuses on the following aspects:

- Right allocation space for data and index storage
- Description of the encryption and data recovery access paths.
- Optimization of data access to allow minimum storage space use.

This level emphasis on the resource allocation storage space for the data and indexes whilst describing the new system forms, records location, data consistence and encryption methodologies.

4.5.5 Conceptual level

According to (Coronel ,2010) this is the level which gives a clear description and relationships of the logical structuring of the database.

It acts as a mediator hiding the complexity between the internal level and external level of the system schemer of how the data is stored physically. The following elaborates what it caters for:

- Entities, relationships, attributes
- Security and data constraints

The entities for instance will have their attributes for example location's attributes comprise of name and id. Any alterations are performed by the database administrator. The data available to the users of the resource allocation system is derived from this level with all the queries being defined within the stipulated links.

4.5.6 External level

This is the topmost secured level which implements the highest level of abstraction within the database (Crocket,2009). Also, known as the view level, access rights are guaranteed in this level. This view allows the use of multiple concurrent users at the same time. Its significant comes in giving abstract information to specific users whilst leaving others basing on access levels. Therefore, this phase ensures security level of the system to be robust.

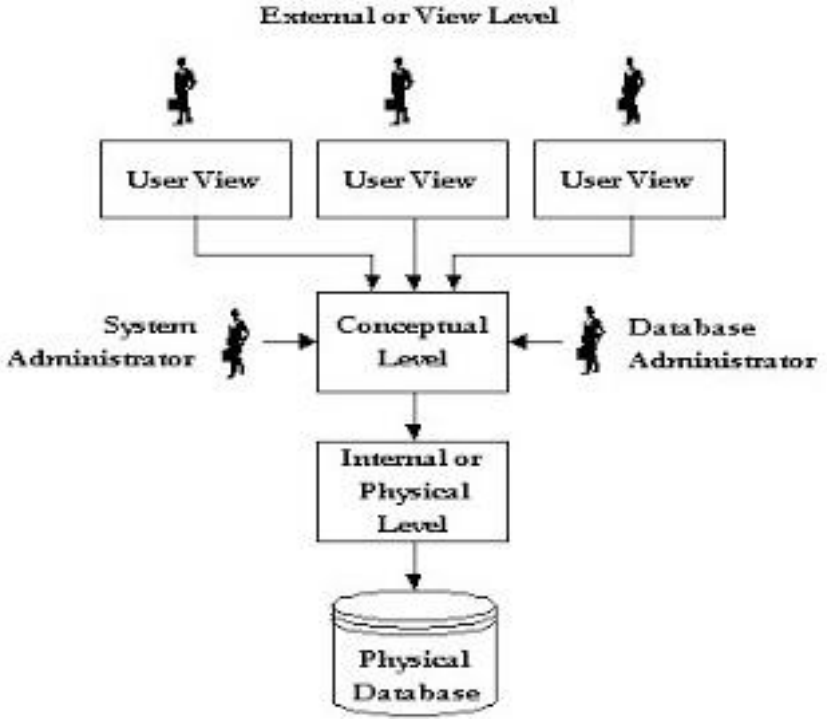

Figure 4.5: Database architecture

Source:www.edraw.com

This is the systematic graphical representation of the data inflows and outflows processes abstractly presented (Rouse, 2007). As a form of representation the entity relationship diagram was used by the system analyst and project team incoming up with the relationships and entities of the resource allocation system.

4.5.7 Entity relationship

An entity relationship diagram(EER) is a data modelling technique which establishes a graphical representation of the entities and relationships (Rouse, 2007). An entity is the object of the system comprising of, people, places or events from the data collected (Rouse, 2007). The analyst undertook the following stage in coming up with the EER diagram.

Identification of the entities – The identification of the relevant stakeholders was performed by the analyst with the help of the project team of the MICTPCS in coming up with the entities which affected the project internally and externally. The entities comprised of the records department, technicians, administrator and the top management board.

Determination of all important relationships –After the first stage of identifying the necessary entities the analyst went on to establish the entity relationships.

Analysis of the nature of all entity relationship – This phase basically dealt with the type of relationship in which the entities were connected or linked to. The overleaf figure 4.6 and figure 4.7 show the entity-relationship diagrams for the objects of the proposed resource allocation system.

Table 4.1: System users

Field Name	Data Type	Description
Id	Int (20)	User unique identifier
surname	Varchar (50)	Last name of user
name	Varchar (50)	) Username for login
password	Varchar (50)	Password for login with MD5 encryption
access_level	Int(1)	Classify users according to privileges

Table 4.2: Activity log

Field Name	Data Type	Description
Activity log_id	varchar	User unique identifier
username	Varchar (50)	Username for login
Date	Varchar (50)	Date accessed into the system
action	Varchar (50)	Classify users according to action taken

Table 4.3: location details

Field Name	Data Type	Description
location_id	varchar	Location allocated unique identifier
Resource name	Varchar (50)	Resource name
Date of deployment	Varchar (50)	Date accessed and allocated resource into the system
Site/location name	Varchar (50)	Location of the resource
Username access	Varchar (50)	Username accessing the system
notification	Varchar(50)	Manipulation of the location details in the system

Table 4.4 Resources details

Field Name	Data Type	Description
Resource _id	varchar	resource allocated unique identifier
Resource name	Varchar (50)	Resource name
Date of deployment	Varchar (50)	Date accessed and allocated resource into the system
Username access	Varchar (50)	Username accessing the system

Source:www.edraw.com

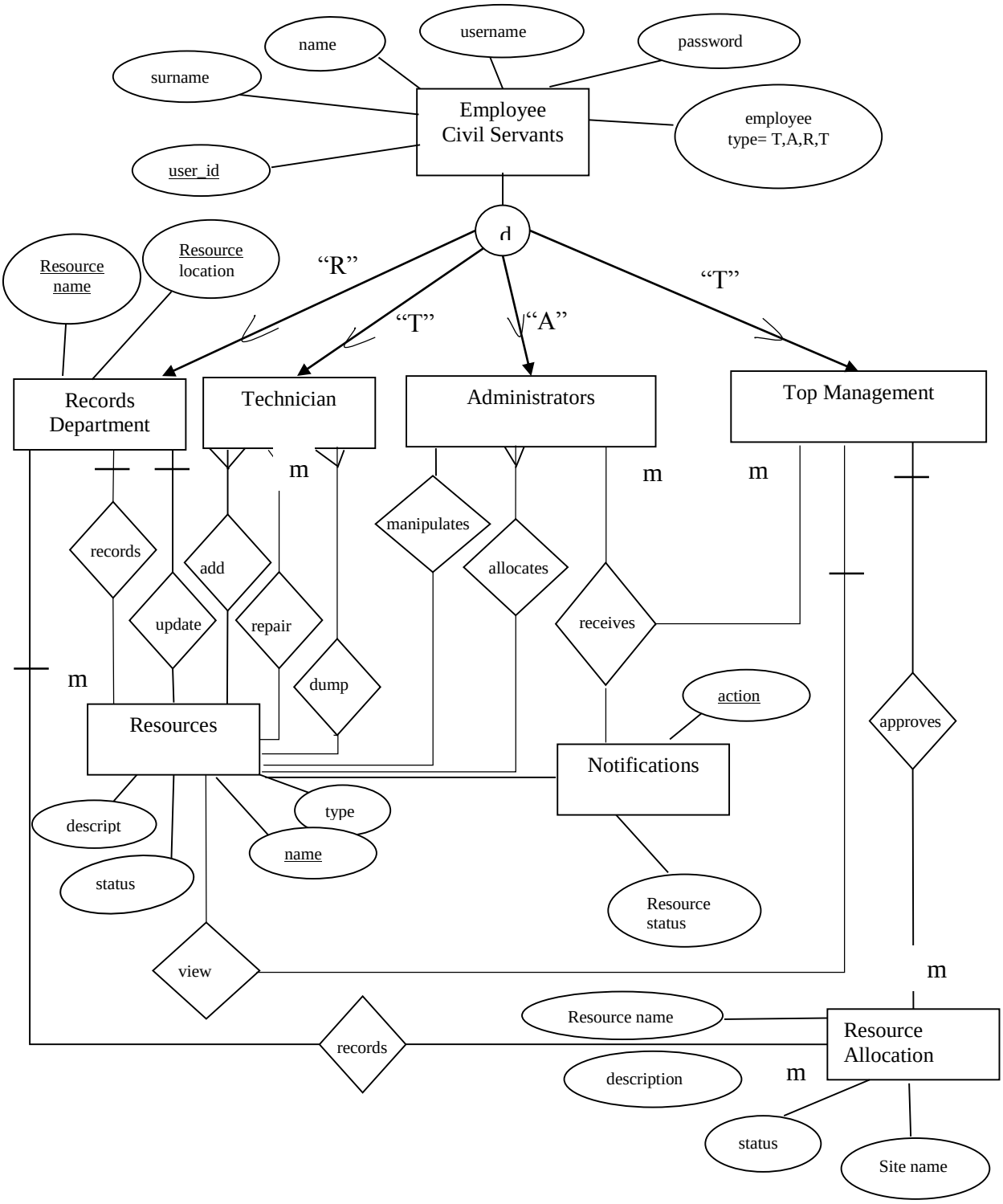

Figure 4.7: EER of the current system

4.6 Program design

Program design is an iterative and collaborative process that involves the design and creation of system modules and how they interact complimented by the use of Unified Modelling Language (UML) diagrams (McConnell, 2004). The subsequent UML diagrams were selected for the process:

- Class diagram,
- Package diagram
- Sequence diagram

4.6.1 Package diagram

A package diagram shows how system components or elements are grouped into packages that interact with each other to satisfy the objectives of the system, and it also shows dependencies amongst the packages (Fakhroutdinov, 2010).

The figure 4.8 illustrates the resource allocation package diagram with the main component's to be used in the implementation of the proposed system.

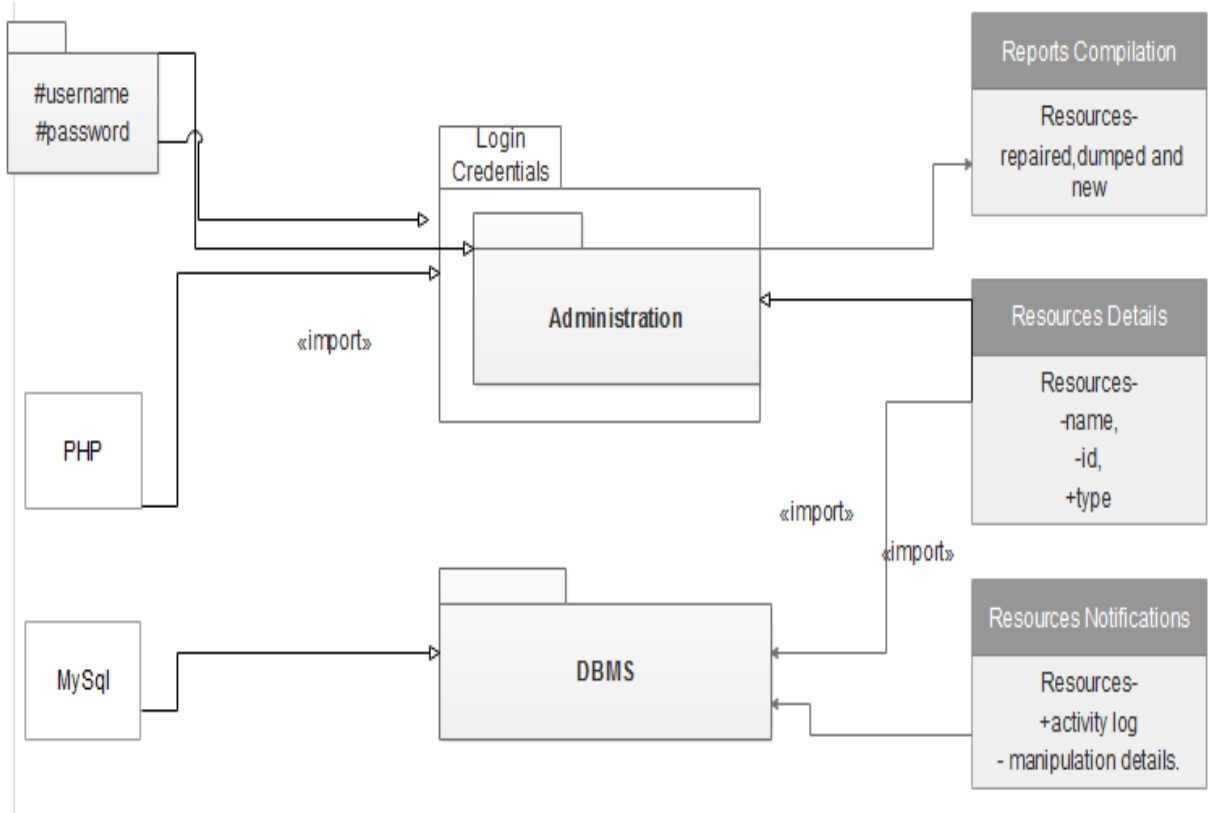

Figure 4 .8: Package diagram of the current system

Source:www.edraw.com

Key:

- private attributes

+public attributes

#protected attributes

<< import>> dependency

The package illustration demonstrations three main packages comprising of login, administration and DBMS packages.

They are the pivotal components relative to the proposed resource allocation system since all the processes and operations originate from the prescribed operation. The use of the dependency allows or grants access to the diverse packages.

4.6.2 Class diagram

A class diagram illustrates the source code dependencies and relationships among classes in UML whereby the same characteristics are grouped together and each class defines the variables and methods/functions in an object (Rouse, 2007). Figure 4.9 clarifies the class diagram showing the crucial aspects of the classes and methods of objects within the proposed resource allocation system.

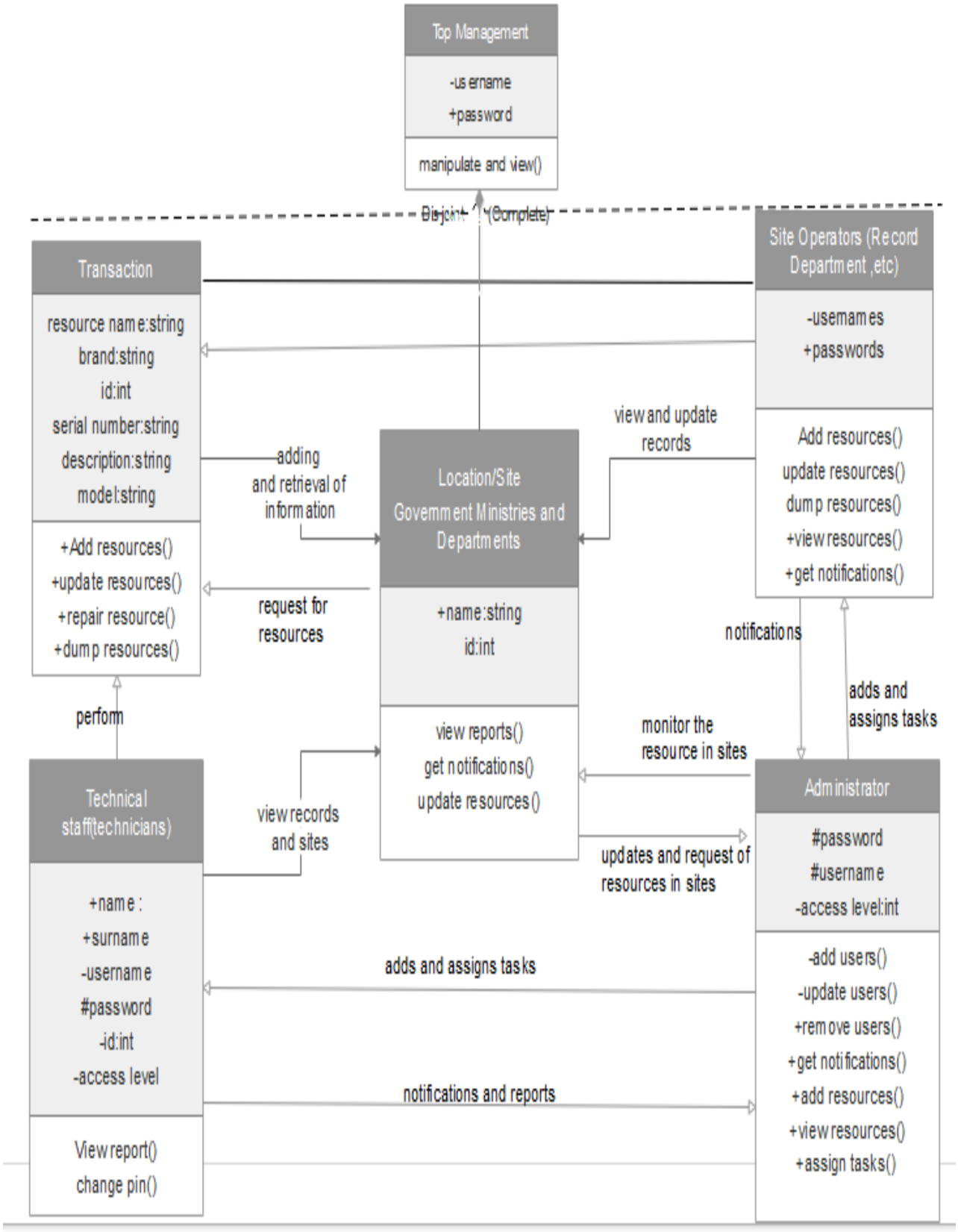

Figure 4.9: Class diagram for the current system

Source: www.edraw .com

4.6.3 Sequence diagram

This is a relational diagram which shows and interlinks how objects operate within a system as illustrated below (Setende, H 2012).

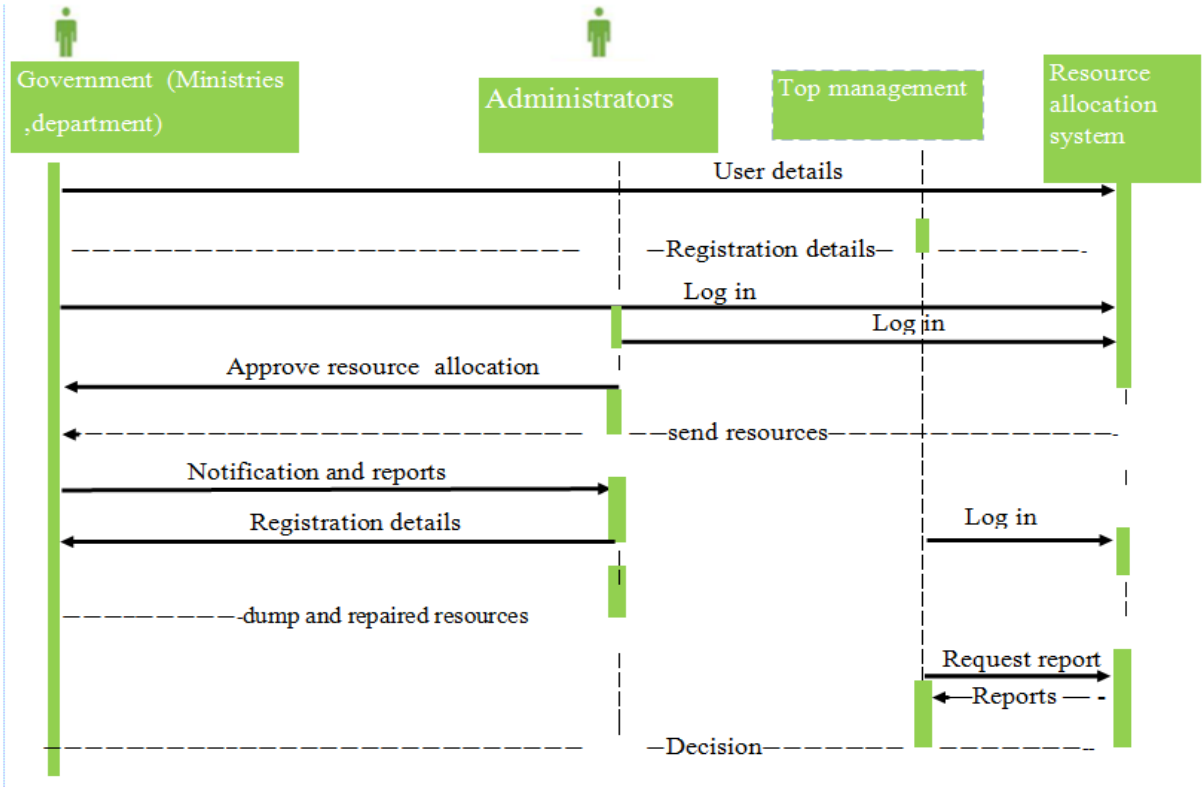

Figure 4.10: Sequence diagram for the current system

4.8 Interface design

Interface design involves the process of creating a platform that end users use to interact and communicate with the system outlining the menus, buttons and forms that enable the input, processing and output of data (Rouse, 2007). Figure 4.10 elaborates further:

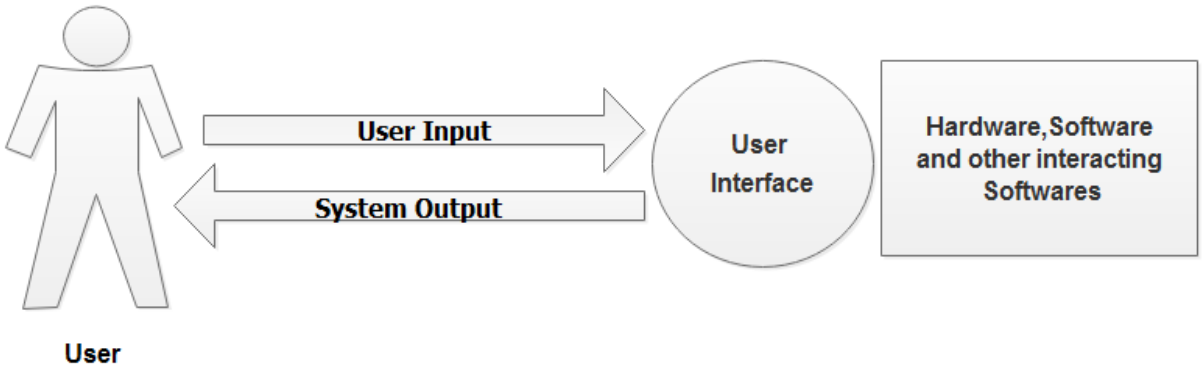

Figure 4.11: User interface

Source:www.edraw.com

The interface design facilitates user to system interaction in a user friendly zone. It allows the system to interact with its stakeholders amicably. The main objective was to establish an online easy navigation, allocation control panel for the intended end user's operations. The guiding principles behind the implementation of the design comprised of:

- Easy, on point labels and navigation buttons.
- Open platform for user feedback
- Guidelines manual for the resource allocation system functionality part.

The proposed resource allocation system comprises of two access levels the

- administrator and other end users,
- technician.

Each access level has got a different interface after the login session on the main page therefore different privileges and users authentication rights.

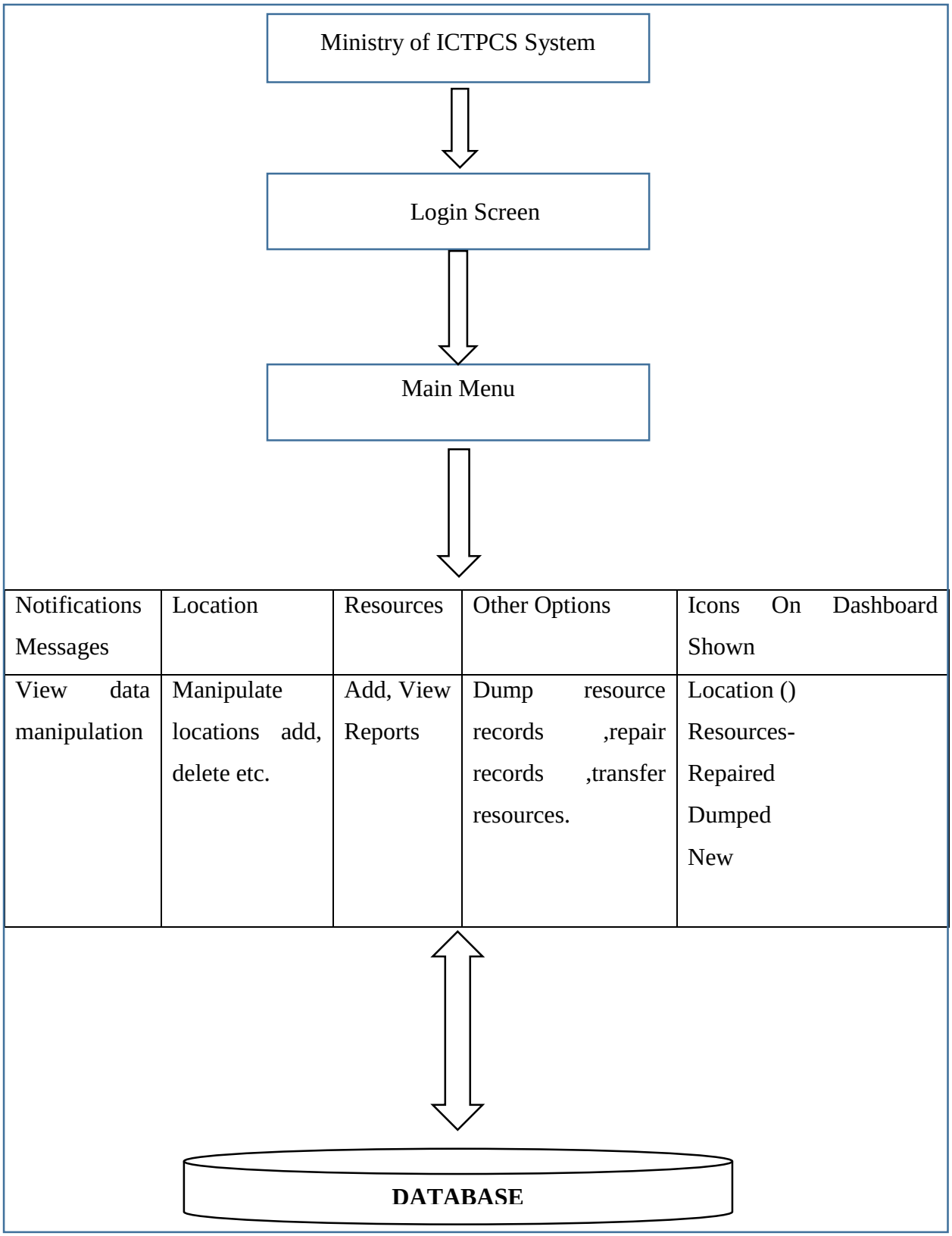

Figure 4.12: Functional structure administrator's view

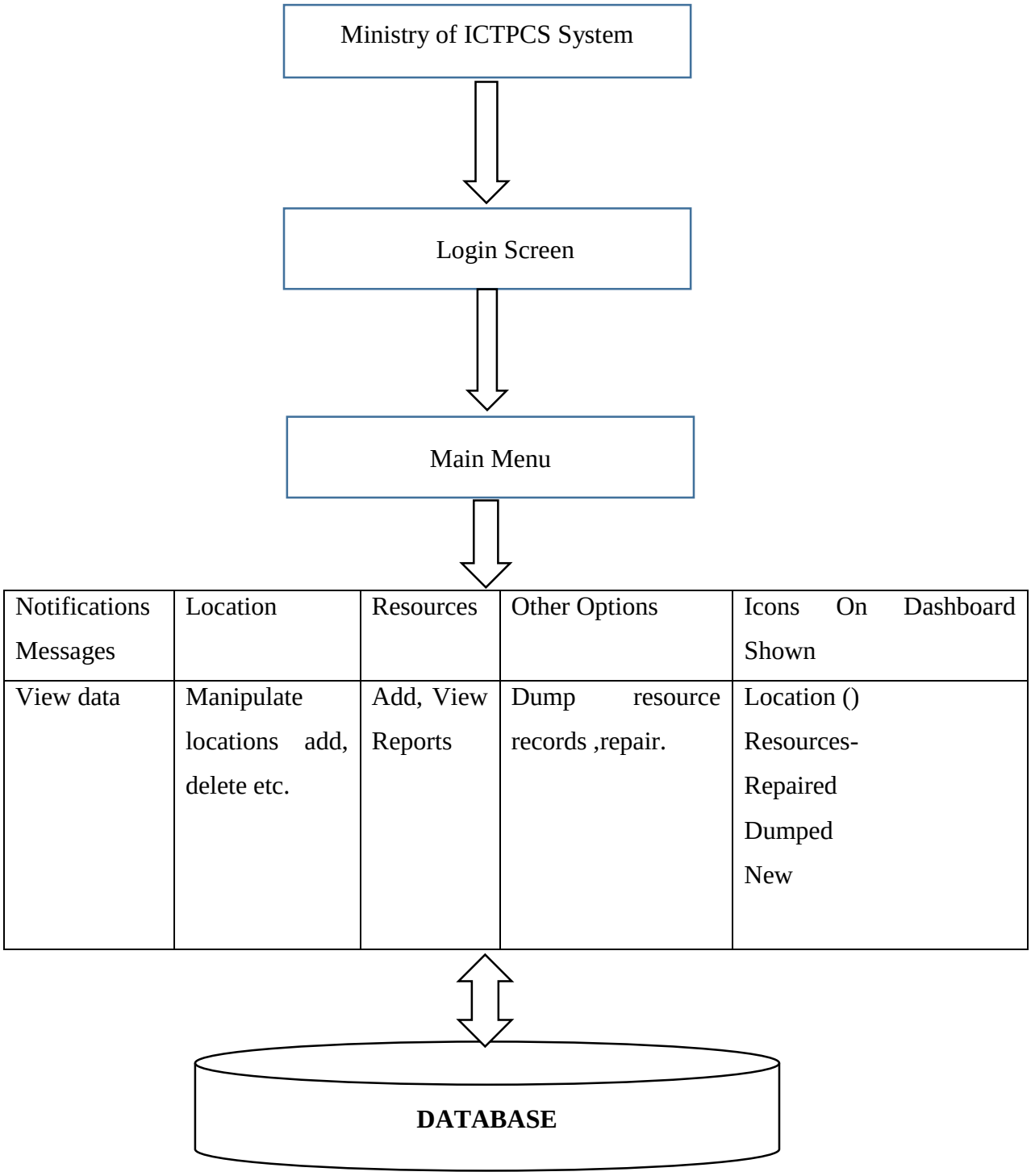

Figure 4.13: Functions of the user's view

4.8.1 Input design

The process involves designing the screens and forms that users use to type in data and information that is used for processing and later on stored in the database. The basic goal of input design is to capture accurate data or information for the system in a simple and easy way. The figure below shows a form that the system users will make use of for the login process.

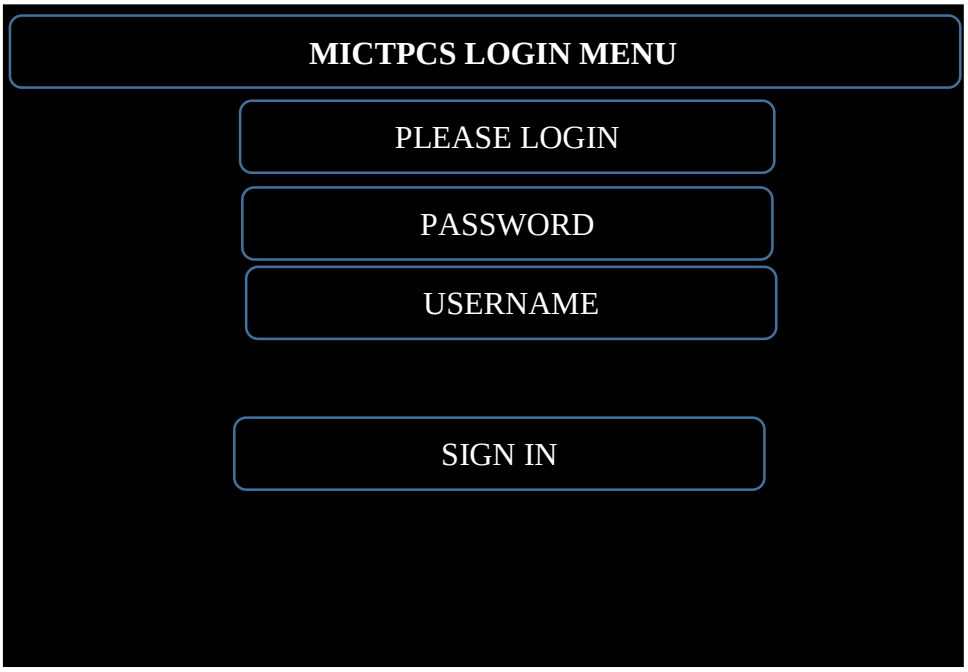

Figure 4.14: Login form

The figure above illustrates how the login form will look like. In addition, the login form will appear as a pop-up form after the user clicks on the option „Login" on the home page of the system. The administrator will be responsible for adding new users to the system and these system users will be holders of the smartcard. Personal information about a user will be captured.

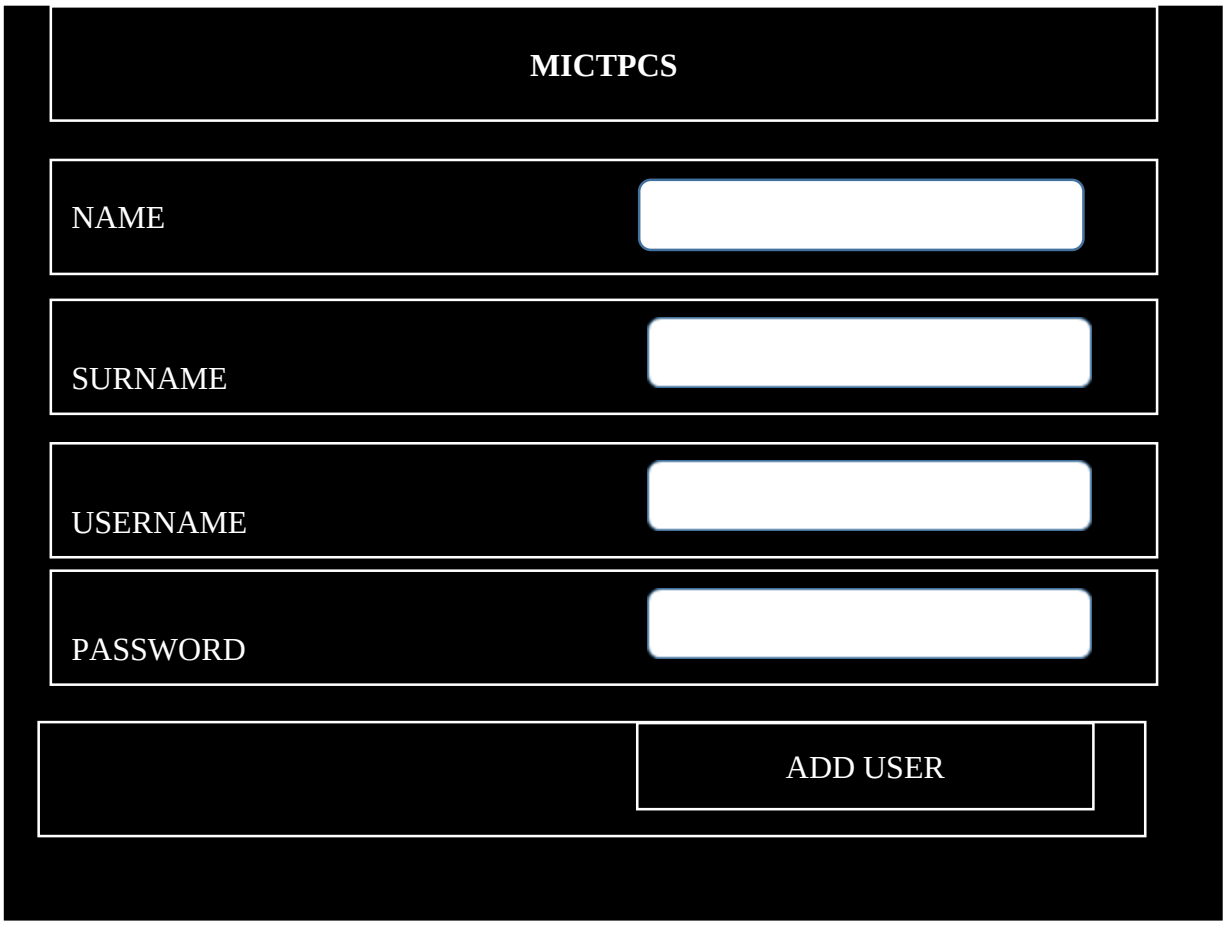

Figure 4.15: Administrative user addition

Second Step:

The admin will firstly allocate the resource as shown below assuming they is new stock.

Device/ Resource Name	Brand	Serial Number	Description	Code	Model
				ADD RESOURCES	

Figure 4.16: Resource adding

Device/ Resource Name	Brand	Status	Description	Location	Model
			STATUS	TRANSFER	

Figure 4.17: Resource transfer and state

4.8.2 Output design

This process is mainly focused on how the end users will view data or information mainly retrieved from the database. These views will be in form of reports that are generated based on data and information access privileges.

The researcher and the project team established the following principles standards to be included in all output views that the system to be developed will provide:

- Reports of the system should be up to date with relevant information thus only the needed information should be presented.
- Also, easy interpretation of the information has got too be a primary target for the system interface being outputted.
- Real time transacting should also be the main focus in implementing the transaction of the system.

The following results show the real-time transaction reports and views to the end user.

Device/ Resource Name	Brand	Serial Number	Description	Code	Model
(value)	(value)	(value)	(value)	(value)	(value)

Figure 4.17: Output of the results

Device/Resource Name	Brand	Status	Description	Location	Model
(value)	(value)	Repaired/New /Dumped	(value)	(value)	(value)

Figure 4.18: Output of the state of the results

4.8 Pseudo code

This is a structural format of a programming language informally high-levelled description of a computer program intended for human language reading rather than machine reading (Zobel, (2013). The system analyst, programmers and researchers encoded the pseudo code in English language mentioned above with respect to the syntaxes (HTML, PHP.JavaScript).

The core modules of the resource allocation system covered the login process, reports, allocation, assigning, adding of resources with user different access levels.

Login (pseudo code)

Click the login users text fields

Enter username and password

Connect to MySQL database

Check if login credentials are entered into the database

If found and match the user's password and username

Check access level for the login credentials

Start „username" session

Redirect page to the user's homepage

Else

Show an error message

Redirect the page to the login page

End if

Adding new Resources and Devices (pseudo code)

Fill information in all the fields then save

Validate all the text fields

If valid then

Connect to the database

Insert into the database the valid information

Show an acceptance notification if record was successfully saved in database

Direct to admin dashboard

End if

Go to the New resources added panel

Assign site location to the new devices (pseudo code)

If location or site of the resource is assigned, then

Redirect page to the location panel

Else if

information entered is the duplicate or null

print error message (enter valid information)

End if

In the location panel (pseudo code)

If status is == new, then

Change to used or damaged (according to the device condition of lifecycle)

Else if transfer==' new location' then

Assign the new device another location

Print report

Else

Do nothing

End if

In the notification sub-menu (pseudo code)

If notification==new, then

Read according to access level of the user

Activity log (pseudo code)

Else if activity log view then

View all the user access of the system

Print report

End if

The template modules of the code were easily elaborated in English language making it an understandable logical code flow for the programmers in verifying error handling, checking and providing the blueprint to the actual programming language as elaborated and found in the appendix section.

4.9 Security Design

This is a specific approach which seeks to create a conducive environment free of impervious and vulnerabilities attacks by the implementation of authentication safeguards, adherence to good programming and testing (Shostack ,2014).

4.9.1 Physical security

This is protection of personnel, hardware, software, networks and data from physical actions and events that could cause serious loss or damage to an enterprise, agency or institution (Fennelly, 2012) .The resource allocation system servers are stored in a data centre were hardening measures consisting of locks, access control cards, and fire suppression systems are present. Secondly, the physical location is monitored by surveillance cameras and notification systems, such as intrusion detection sensors, heat sensors and smoke detectors.

4.9.2 Network security

This is the authentication of the data and networks of the organisation by devising strategies which prevent unauthorised entry (Shostack, 2014).

Once authenticated, a firewall enforces access policies such as what services are allowed to be accessed by the network users. Though effective to prevent unauthorized access, this component may fail to check potentially harmful content such as computer worms or Trojans being transmitted over the network. Anti-virus software or an intrusion prevention system help detect and inhibit the action of such malware such as the Sophos anti-virus which was implemented by the system developers.

4.9.3 Operational security

Operational security involves enforcement of policies and procedures (Fennelly, 2012). These procedures detail the type of permitted procedures and that which is prohibited. Controls to be put in place include disaster recovery policy which entails procedures to be undertaken in the case of unexpected power cuts.

4.9 Conclusion

This phase was basically based on the issue of integrating the system stakeholders and the environment to allow the operations of the transaction being undertaken on a daily basis.

The storage of data and other network aspects were among the main functionalities for the proposed resource allocation system. Chapter 3 attributes played a critical role in the establishment of a well-researched system to be implemented since the requirements gathering process involved the end –users in designing the prototype figure of the system before its implementation. Next up is the implementation and maintenance phase which comprise of testing, coding and installation of the developed system. End-users will have their role when it comes to testing the application software.

Chapter 5: Implementation phase

5.1 Introduction

According to Moreira (2004), system implementation is a procedure in which development is defined, making a usable operational system whilst meeting all user requirements. This encompass the use of programming language to meet the specific objectives.

As elaborated and stated in prior phases the project team was focusing mainly on the substantial blueprint of the proposed system to be implemented at the same time specifying non-functional requirements and functional requirements. The project team's mandate in this phase involved writing the source code for the development of the resources allocation system. testing, validation and verification of the system, maintenance, training of the users and the recommendations by the researcher to the MICTPCS.

5.2 Coding

Coding is the symbolic arrangement set of computer instructions undertaken by the system developer in developing computer programs (Sierra and Stuart,2015). The system was developed with PHP code, HTML code and JavaScript code. The main prospective stakeholders, participants during the development of the resource allocation system consisted of programmers of the MICTPCS, database administrators, system analyst, researchers and end users of the resource allocation system. Sample code snippet is shown in the appendix section.

5.3 Testing

Testing is the technique of investigating the total quality management of the product in a bid to deliver adequate information of the service or product under test to its stakeholders (Welsh and Ryan,2015). This provides an objective, autonomous view of the software allowing the organisation to appreciate whilst understand the risks of implementing the system.

The technique of back-end to front-end system components testing was implemented by the project team to verify the compliance of the system requirements. Figure 5.1 elaborates the stages involved with the testing techniques:

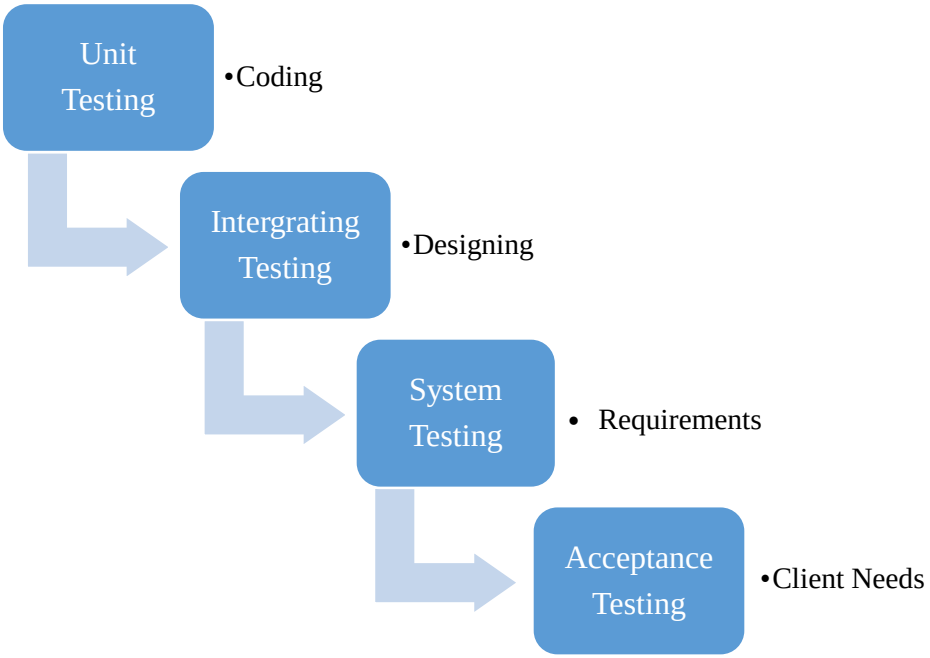

Figure 5.1 Testing techniques

The project team and the researchers came to the conclusion and chose:

- ❖ black-box testing,
- ❖ and white-box testing methodologies.

Black-box testing

The independent tester is only interested with functionality of the resource allocation system's input specifications and expected output results without taking consideration of the process involved with the algorithms or any programming language code Zobel (2013).

The method was widely imposed to all the levels of testing techniques especially the integrating and acceptance testing techniques.

White box testing

This methodology tackles the internal structure components testing encompassing the source and algorithms (Furman ,2013). The unit testing technique is the one which uses this method vastly in bug and error code checks relative to the integrating and system testing. The system testers of the project team undertook this initiative with the aid of system developers of the MICTPCS.

5.3.1 Unit testing

Unit testing involve short coded fragments developed by programmers and occasionally with white box testers in respect of system functionality check (Welsh and Ryan,2015). Units comprise of entire module, individual function in procedural language and entire interface in

object oriented programming. For instance, the function for allocating resources was tested if it allocating the resources accurately to respective sites correctly. In the bid to realize the dependencies isolation of the units or code body reveals unnecessary data spaces within the system the system developers and project team undertook the test based on white-box testing methodology resulting in immediate bugs being found within the source code. The design techniques used for white-box testing comprised of the control flow (deals with the flow of executed code or program) and data flow (deals with data transfer from one component to the other).

5.3.2 Integration testing

It is the logical extension of the unit testing technique in which software units are combined for testing as an attempt to validate their interaction whist detecting interface's shortcoming or defects (Welsh and Ryan,2015). The project team and developers conducted the tests using the bottom–up approach for easy identification of defaults and errors. The black-box allowed, success and error handling cases simulated via suitable parameterised data inputs whilst facilitating.

Integration testing was conducted using a bottom-up approach which involved testing smaller combined units followed by bigger combined units called modules. The bottom-up approach was an efficient method of detecting errors and the project team quickly and easily identified and corrected detected errors as they were identified. Both methods were vital in dealing with the low level and high level system unit testing.

5.3.3 System testing

System testing is a sub-testing technique of the black-box method which does not require the inner code or logic designing (Muolo .M ,1992). Principal rules depict the results from the integrated as the main inputs to be used by the system testing. The system testing seeks the detection of the internal-assemblages and holistically the system as a whole. The project team and system developers went on accordingly to the following guidelines where-by independent testers tested the system:

- Usability
- Graphical user interface
- Recovery
- Security

This phase typically focussed on validation and verification of the inputs, processes and the outputs transparency. The irregularities were cross checked before the final phase from the end users at the acceptance testing.

5.3.4 Acceptance testing

This was arguably the utmost vital testing phase which the actual end-users took a hands on assessment and evaluation of the developed system conformity to the user's specifications according to the functionality specifications of the system (Muolo,M ,1992). This phase put forth arguments comprising of the capability of back-end functions to hold the data within the database and concurrent running of multiple users which helped the project team to expand the specifications accordingly to user's needs. The black box method was used to fully overlook the inputs, processes and the outputs.

Conclusion on tests conducted

The exertional work conducted by the project team during the testing process was a vital exercise involving the rectifying of bugs and defects especially within the acceptance and unit testing techniques. All these techniques were documented for a futuristic in outlook reference in instances of defects. After the testing techniques checks, the system was ready for installation, implementation and user trainings for the new system.

5.3.5 Verification and validation

The main questions which needed answers comprised of the following:

- Verification: Is the system being built correctly according to the functionality specifications?
- Validation: Is it the correct system to be built?

The above-mentioned questions were addressed to the testing techniques the project team carried out, encompassing unit, integration, system and acceptance testing. The diagram below clearly elaborates the validation and verification aspects:

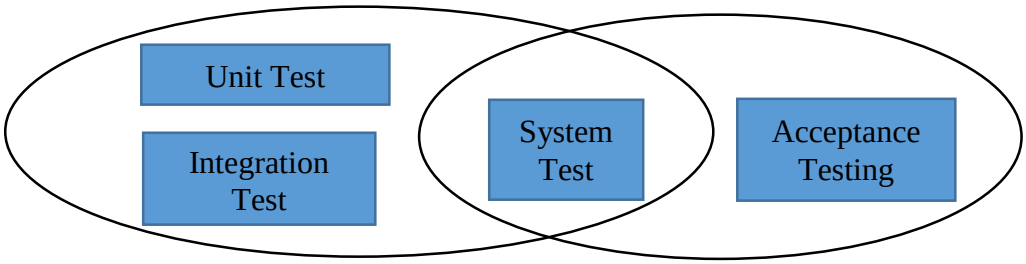

Figure 5.2 Verification and validation

5.3.6 Validation

Validation of the system depicts the integrity aspect of the database maintenance therefore user notifications of wrong credentials into the login systems panel would be followed by a prompting notification of retrying again to access the system. As illustrated below in figure 5.2: Till the correct credentials are entered then the system would proceed to the dashboard.

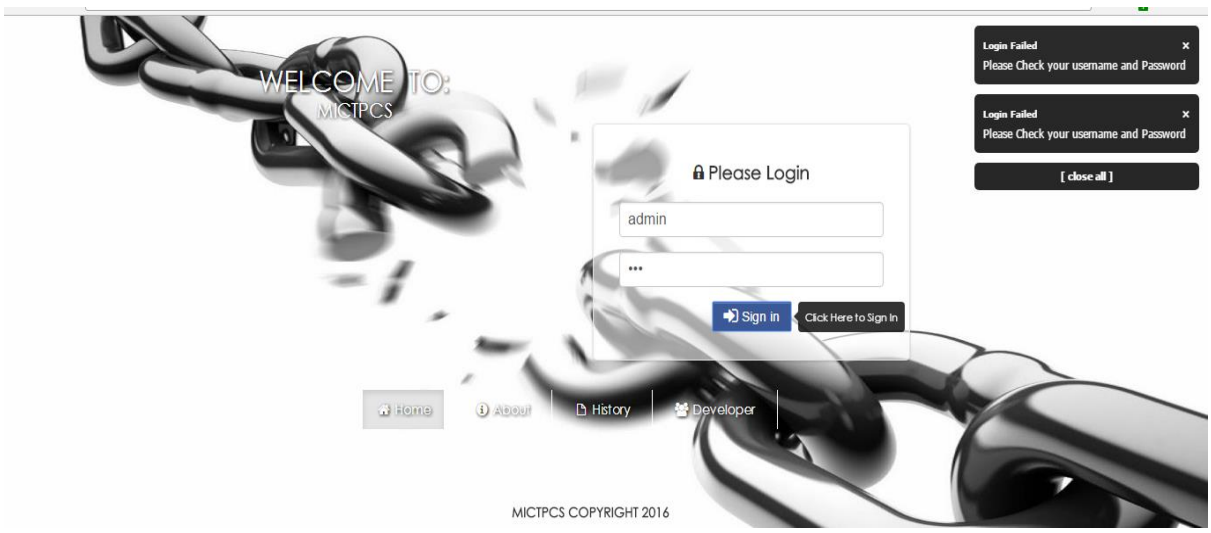

Figure 5.3: Validation of the login system (wrong login credentials)

Interms of the user password the administrator is the one responsible for adding users and the other administrators for remotely located site within the government ministries and departments as illustrated in figure 5.3

b) User Registration

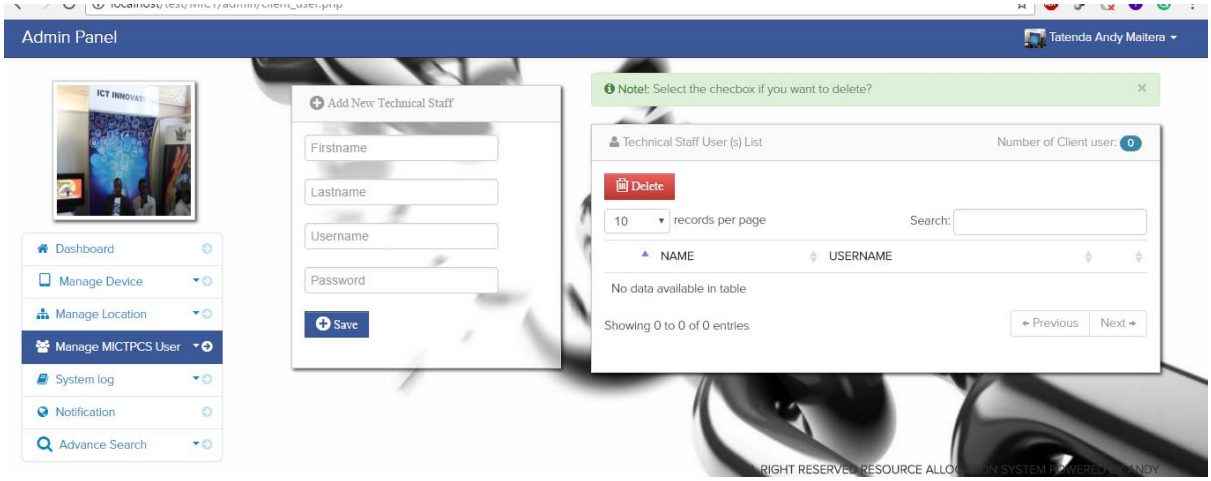

Figure 5.4: User registration by the administrator

c)**User registration wrong credentials**

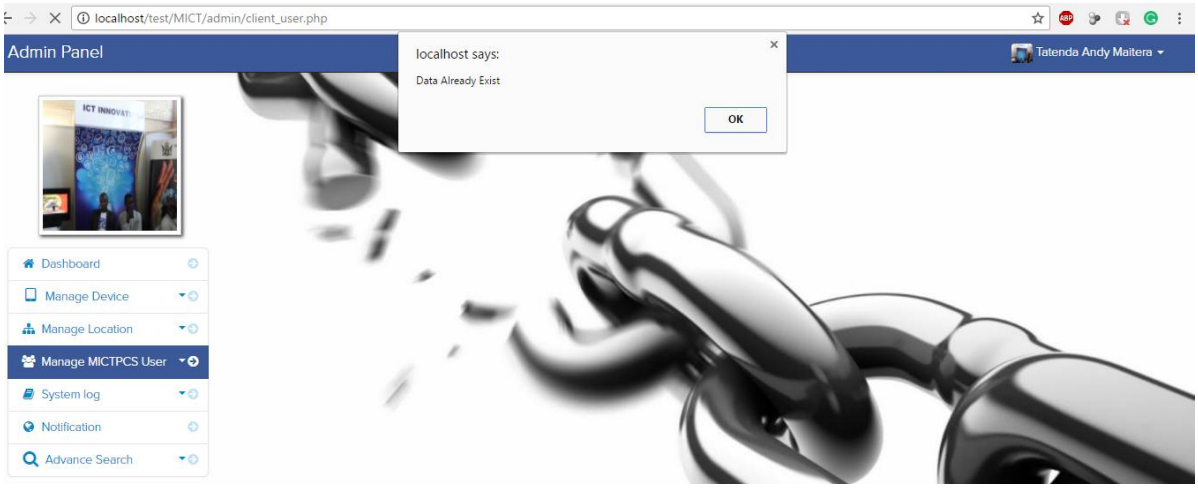

Figure 5.4: User registration wrong credentials

5.3.7 Verification

Verification is checking that the product was developed in the right way (Desikan, 2008). This means that the system must confirm with the prerequisites made by users. A software has to meet what was proposed or intended to address. This strategy was used so as to ensure that the product does not deviate from what is supposed to be answered. System performance was checked with data input to check if it response as desired by the user. This was done in correspondence to system objectives.

5.3.8 System objectives versus performance

The entire MICTPCS~RAS system was fully tested for defects and errors. These were corrected necessarily. The system was checked if it meets the user defined requirements. The following are objectives as they were check in the system.

Objective 1: Enable remote allocation of resource transfers, and reduced transport costs.

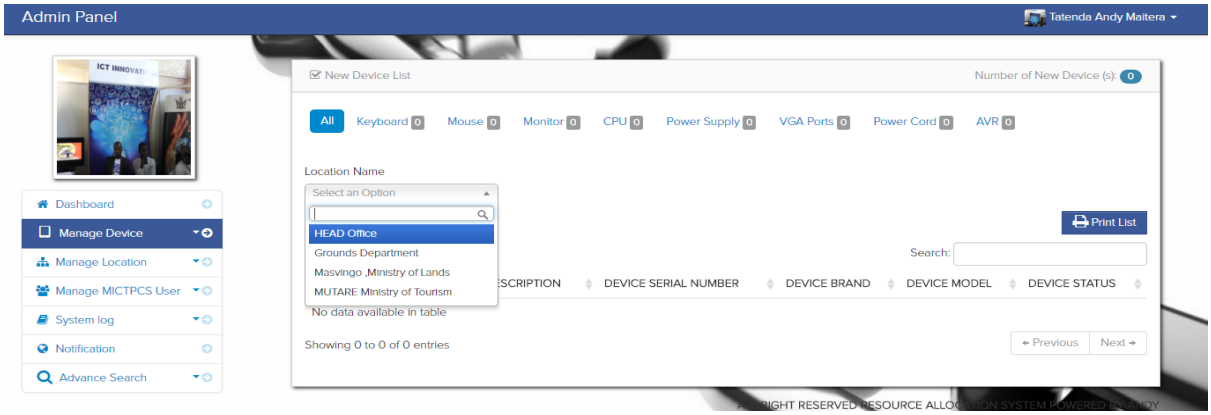

Figure 5.5: Allocation of resource

Objective 2: Enable generation of real time activity logs, reports and notifications.

User notifications and activity log reports provide relevant information of the user's activities as shown in figure 5.5. As a security feature for the organisation the activity logs would be the one showing the time out of each user whether being the admin or the users. This will allow a clear security mechanism of detecting what would have transpired during the user session period within the system in case of fraudulent allocation of resources by the users. The action undertaken, date and username will be the main aspects.

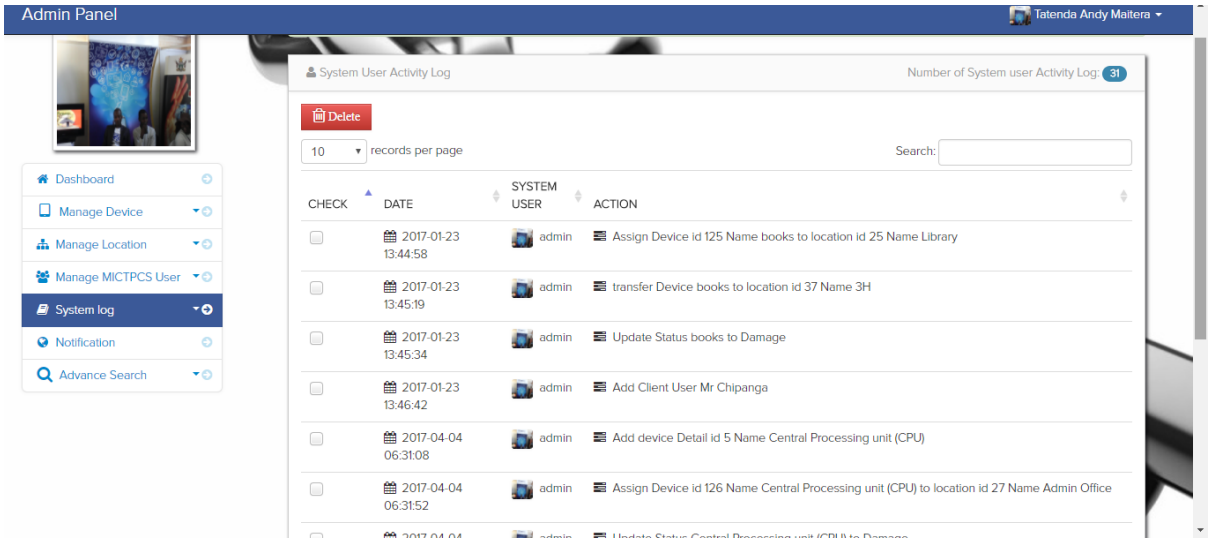

Figure 5.6: User notification and activity log

Objective 3: Enable navigation of the network sites within the LAN, WAN, and MAN

After clicking the location, it presents what is in it as elaborated in figure 5.7 by the research whereby the transfer button would transfer misplaced resources to their actual destination as shown in figure 5.8 and the status button would show the if the resource is new, damaged or used.

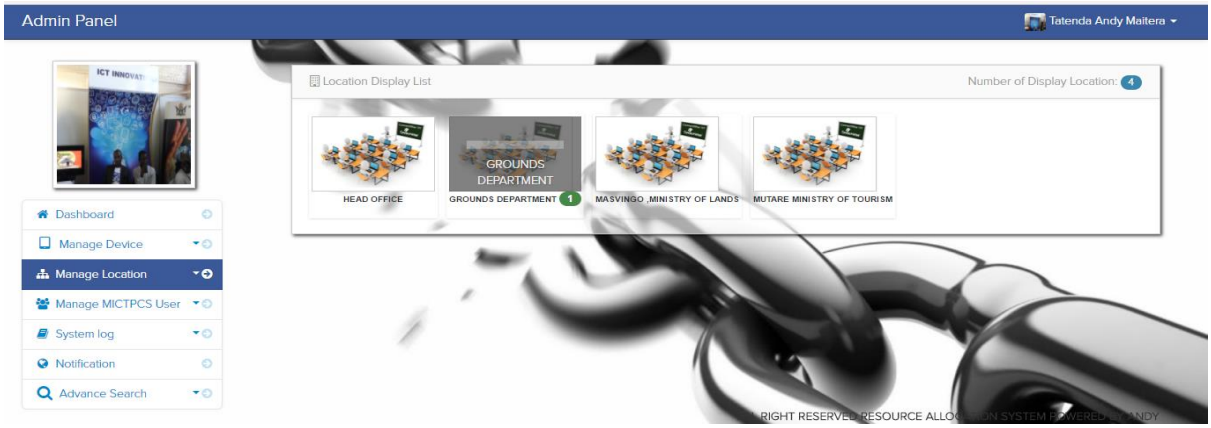

Figure 5.8: Location panel

Objective 4: delegation of tasks through confirmation reports

The resources will be given the status according to the condition of the resources at hand as illustrated below:

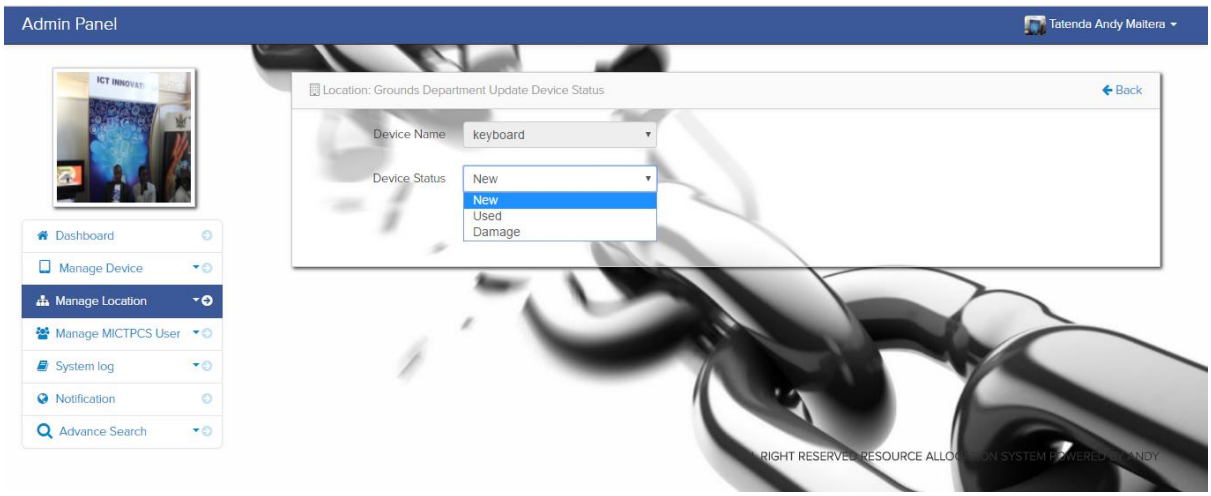

Figure 5.9: Administrator assignment of the resources status

5.4 Installation

This is the act of creating an executable program on a computer (Ould and Unwin ,2015). After a thorough assessment of test for the developed system the MICTPCS end users can initially start utilizing the system software.

The software was installed on the prescribed server and the other computer as an applications server and two other administrative machines at the MICTPCS headquarters. Remote accessibility in government departments and ministries by other client machine via the LAN and MAN ip-address and dhcp s' will be the communication links for accessing the system software's.

5.4.1 System changeover

This is a strategic smooth shift from a particular way of operating the daily routine of the organisation into another approach of doing things with decisive mitigation of disruptions to organisations activities (www. golang.org,2013). They are three strategies which were viewed by the project team and system analysts comprising of:

- phased implementation
- direct changeover
- parallel running.

5.4.2 Phased implementation

This is a staged method which involve the changeover of the specific unit or module of the system vital for transformation within the organisation (Ould and Unwin,2015).

Advantages: limited risk since the module singled out is the one affected only therefore, if the unit is a success the other modules will follow suit as a learning curve.

Disadvantage: Time consuming when being implemented.

5.4.3 Parallel running

This is the approach of operating with live data between the current and new systems whilst functioning side by side (Ould and Unwin,2014). The MICTPCS old system would be operating adjacent to the new developed system whilst the project team and managers would be evaluating the efficiency and reliability between both systems.

Advantages

Easy evaluation of the efficiency and effectiveness of the system since both the new and old system would be operating adjacent to each other.

There was room for the new system to be improved from the new identified defects.

Disadvantages

It is time consuming and involves high risk since the actual live data will be the one being used.

5.4.3 Direct changeover

Direct changeover is the complete halt of the old systems operations and paving way for the new developed systems operations (Ould and Unwin,2014).

Advantages

It is the easiest, less expensive and quickest platform for the system changeover strategy.

Disadvantages

It is very risk in case of inefficiency of the system the organization will sustain bottlenecks in its operations.

Conclusion of the system changeover

The researcher came up with conclusion of direct changeover due to the high cost involved in parallel running two project at the same time high labour costs and time consuming aspect of the phased implementation method. Most of the defined problems were addressed by the developed system therefore this was the best approach of implementing the project strategically.

5.4.4 Data migration

This is the transference between data formats, storage or computer systems from the source platform to the targeted platform efficiently, accurately and effectively without any data loss (Morris, 2012). It comprises of two types the big bang migration and the trickle migration.

Big bang migration

This is the holistic approach of stopping all the processes and daily operations of all applications and databases then putting the force in data migration (Morris, 2012). Eliminates possibilities of risk during the process of migration due to shorter migration time though the real time data would not be available at that particular moment.

Trickle migration

This is the approach which the data is migrated to partially basing on the most crucial areas whilst the operations would be running parallel (Morris, 2012). It allows lesser disturbances to the workforce without system downtime however it is time consuming.

Conclusion of the data migration

The system used the big bang strategy of migrating data to the new due to the fact of its convenient, reduced time and lesser delays since it was performed outside the real time transaction processing during a public holiday compared to the trickle strategy.

5.4.5 User training

Training clarifies more on enhancing the employee's performance. The MICTPCS employees are now able work efficiently and effectively whilst achieving their daily work objectives.

The researcher, project team and the industrial relations manager came up with a conducive schedule for the training of the end users. The developed new system comprises of two access levels:

Administrators: Top management, Record Department, System Engineers, System Analyst.

Users: Technician (Network and Software technicians), Government departments and ministries

All administrators are from the MICTPCS and the user's civil servants from the other government ministries and departments which would be available for data confirmation of resources.

Main agenda

The training sessions were conducted as follows:

- Introduction to the resource allocation system (overview of resource allocation system)
- The benefits as an innovation to the organisation
- How the system functions (overview of the functionality and modules within the system)
- Access level training (based on the level of authentication)
- Practical demonstrations of processes involved in the system
- Security protocols and recovery actions
- Question and Answer session

Access level manual

Results and evaluations

The training was a great success and yielded fruitful results since each end user present and the administrators were left with all the literacy skills of operating the developed system.

The employees were inspired and motivated by the training workshop which allowed the system engineers, administrators to be liable in allocating the resources. Ability of report, notification and security features were also addressed both the users and administrative access

levels. User manuals were provided by the trainers via hardcopies and email links of the participants involved for further purposes.

5.5 Maintenance

Maintenance is an ongoing process of curbing unplanned and gazetted disruption within the system allowing a smooth flow of operations (Beizer. B,2008). This imperative note should be performed concurrently to avoid system disruptions. The system administrators came up with the proper maintenance plan accordingly with the best methods of system upkeep. The type and methods of maintenance comprise of:

5.5.1 Perfective maintenance:

Is the involvement and identification of the best new modernised features for system functionality as per system specifications to ensure flawless quality management system (Graham, 2008). The main goal was to put in place an improved version of the resource allocation system This allowed efficiency in resource allocation and increased effectiveness of the operations by reducing transaction time of allocating resources notifications and delegation of tasks.

5.5.2 Adaptive maintenance:

This ensures the flexibity and portability of the systems operations in diverse environments operating systems and other hardware platforms. This allows the ministries client machines to access the maintained system remotely maintained.

5.5.3 Corrective maintenance

This is an error and bug fix within the system. System checks and optimizations of the system on a regular basis to be undertaken twice per two weeks results documented. Allows and reduce the risk of hardware and system software failures.

5.5.4 Preventive maintenance

This mechanism acts as a retrieval plan afore and after the deployment of the system within the ministry (Graham, 2008). As a preventive measure of any disaster a back-up plan was imposed in case of any defects the systems operations. The operation of the software will always run continuously within the changing environment.

5.6 System back-up

This is the state of data, files within the operating are replicated and stored to a different place in case of system crashes (Beizer B, 2008). The source code was to be stored in secure servers, external backup taps. An imposition of backing up the data on a weekly basis was suggested and implemented. The system administrators would be the ones involved with backing the data-up as illustrated in figure 5.10.

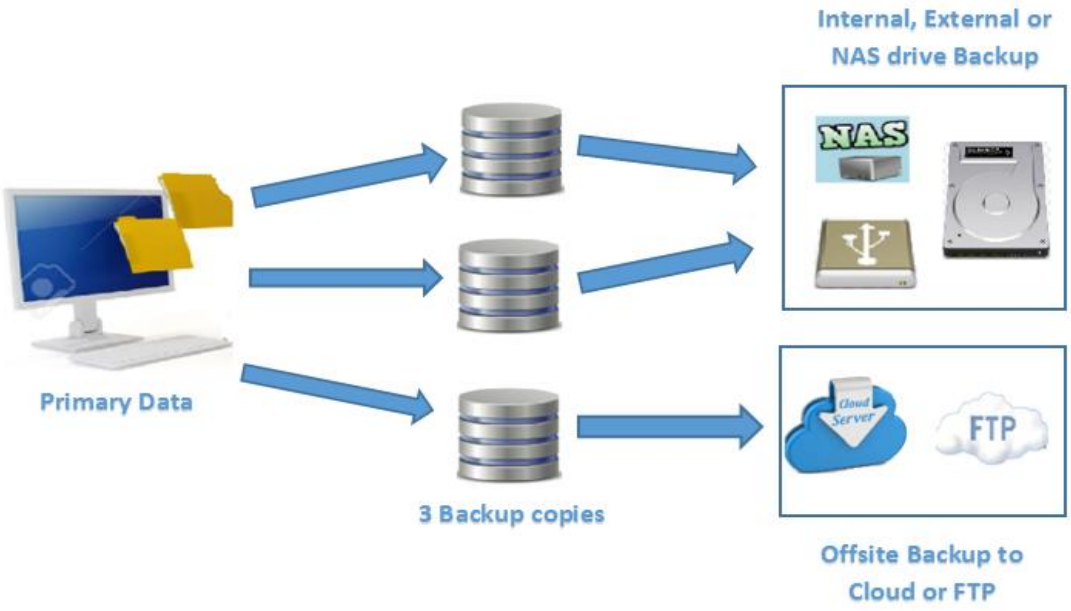

Figure 5.10: Back-up strategy

5.7 Recommendations

The researcher went on to a give the MICTPCS the needed recommendations as stated below:

- The system should be a mobile application in the future course.
- The use of email integration into the system should also be implemented to allow efficiency in communication
- GPS coordinates of the site should be implemented also for the exact location.
- User manual: Each system user should be equipped with the user manual of the system.
- Upgrades of software: the ministry should occasionally check for latest software upgrades and implement if available.
- Maintenance should be done on a regular basis by the I.T department to reduce the systems discrepancies and defects.

5.8 Conclusion

The resource allocation system is a standing innovation wonder within the MICTPCS that has transformed the labour intensity system into an efficient piece of ice cake dripping system reducing the bottlenecks of allocating resources, delays in finding network sites, lack of activity and notification within the system. The system was successfully developed and implemented resulting in the MICTPCS appreciation. However, all was done and said with only the negative entropy being the loss of time undertaken due to the financial constraints at certain phase of the project development resulting in an extended span of the system implementation work plan even after these negative contributing the system was a success.

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Appendix A : User manual

Login Page

The login page enables the user to login into the Resource Allocation System using passwords assigned to each individual. Providing correct credentials will enable the user to access the system. A registered user only can have access to the system. Each user will access the system according to different access levels and will be directed to the pages they have privileges to access.

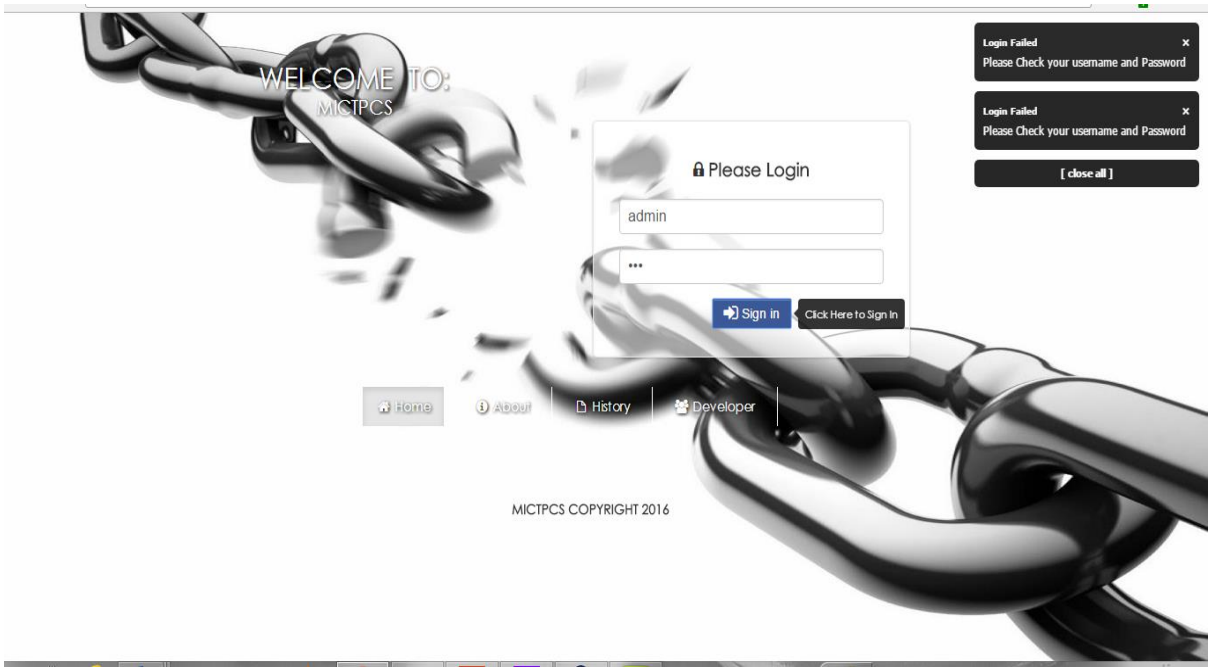

Figure A.1 Login page

Admin homepage

The administrator after logging into the system is provided with the following homepage with different modules that are adding or deleting a user, adding or deleting a department.
The dashboard comprises of the new, repaired dumped and location or sites of the resources.

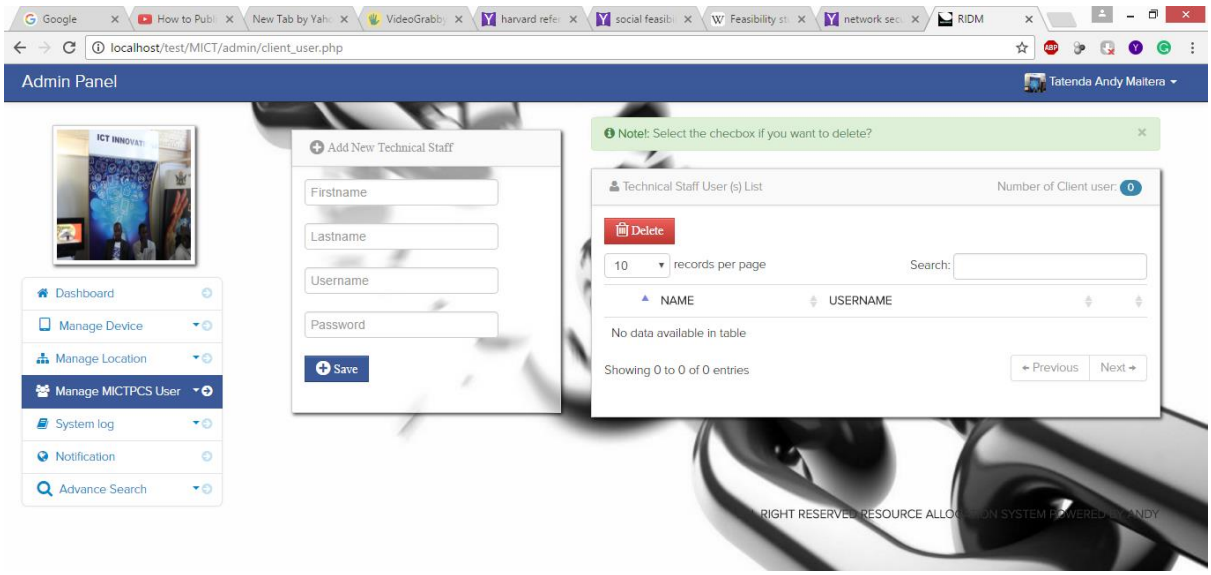

Figure A.2: Admin creates a new user

In this page the admin will create the system users that is the administrator will enter user credentials that is user first name, last name, gender, email, contact, user type and also provide a user image profile. Administrator must fill all the required fields otherwise the system will not submit the details but will alert user to provide all information required.

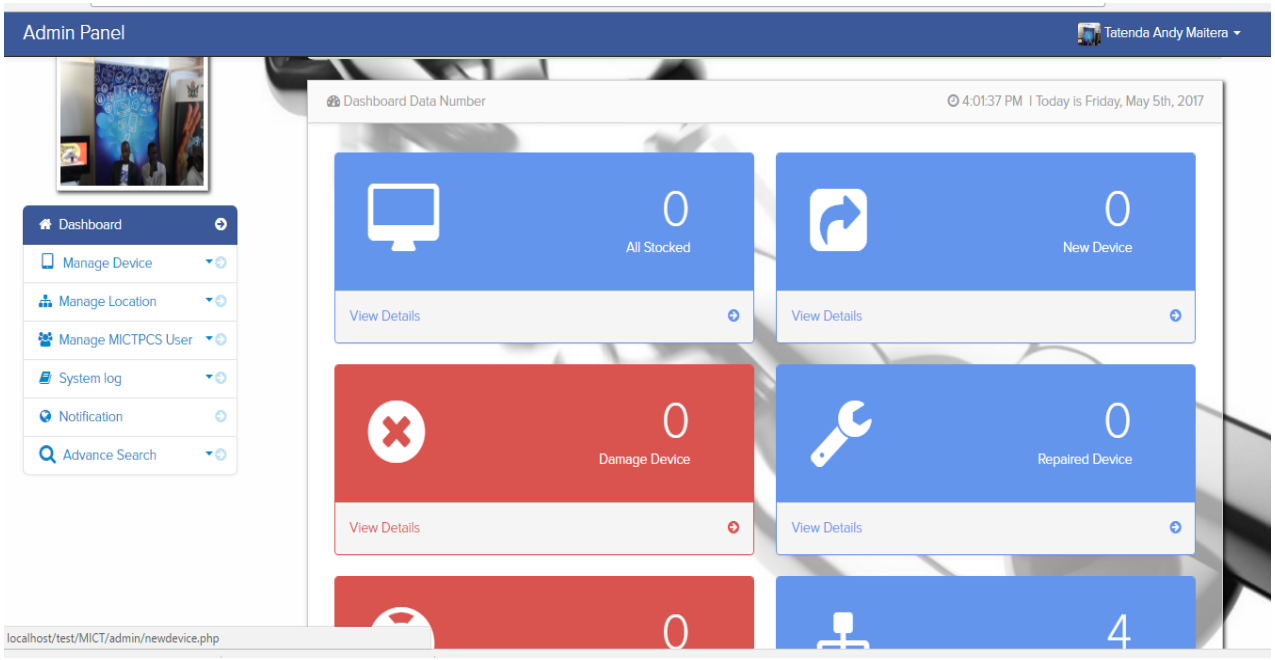

Figure A.2: Admin view of the dashboard

The administrator after logging into the system is provided with the following homepage with different modules that are adding or deleting a user, adding or deleting a department.

The dashboard comprises of the new, repaired dumped and location or sites of the resources.

The database is now being populated with more resources before being assigned to diverse sites.

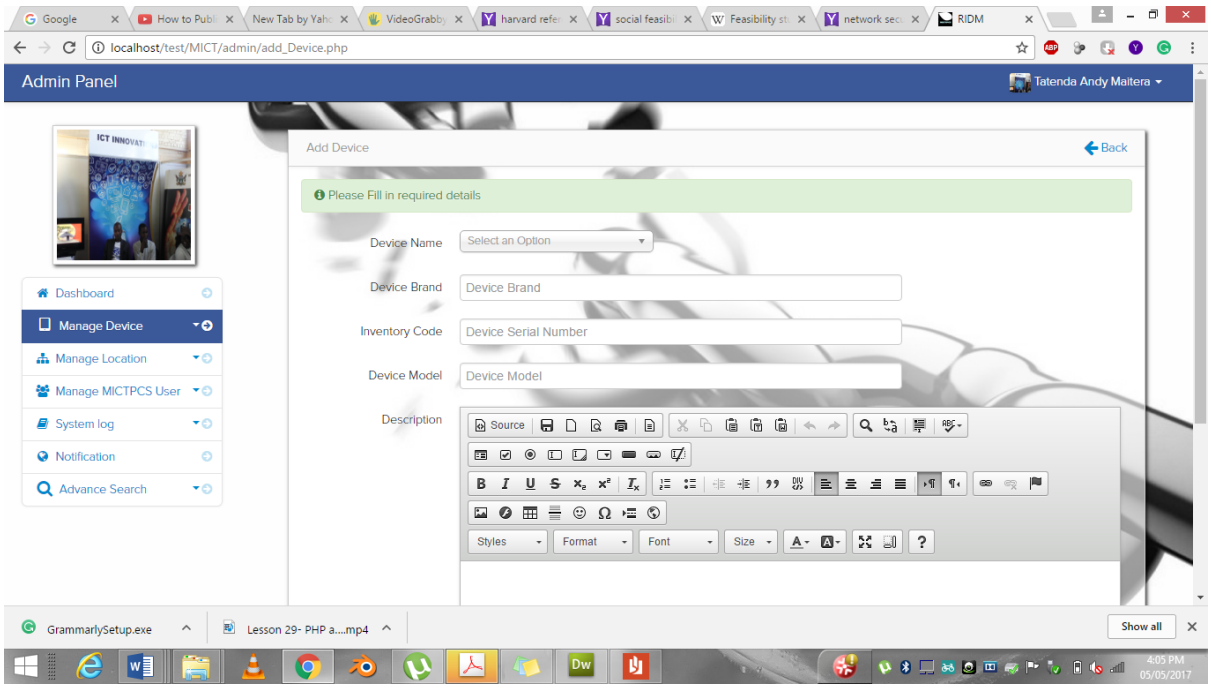

Figure A.3: Adding resources

This involves the condition when good have been recorded as shown above now being dispersed to diverse locations.

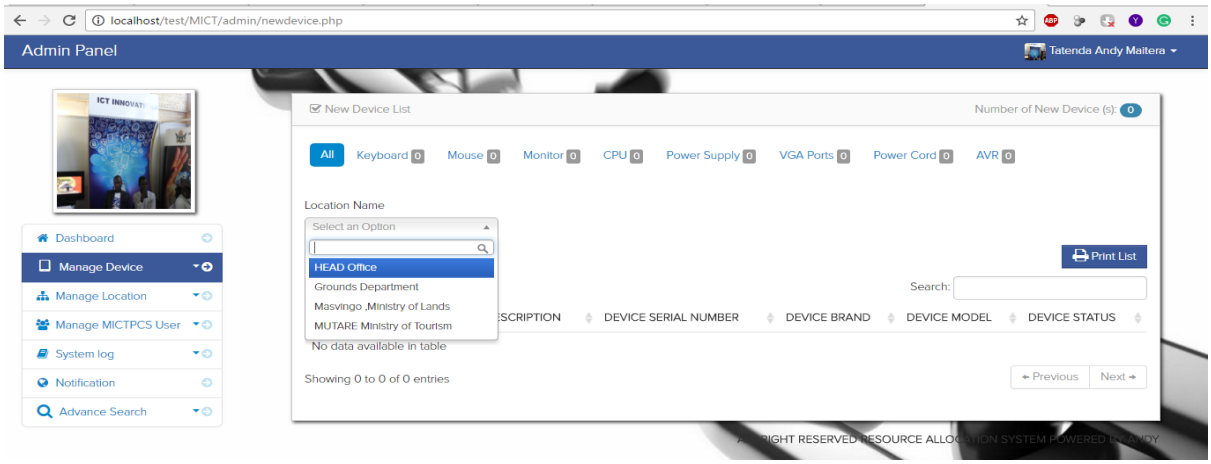

Figure A.4: Allocation of resources

The following diagram presents how the resources in the sites will be managed by the administrator in case of any defects or errors.

Figure A.4: Management of the allocated resources

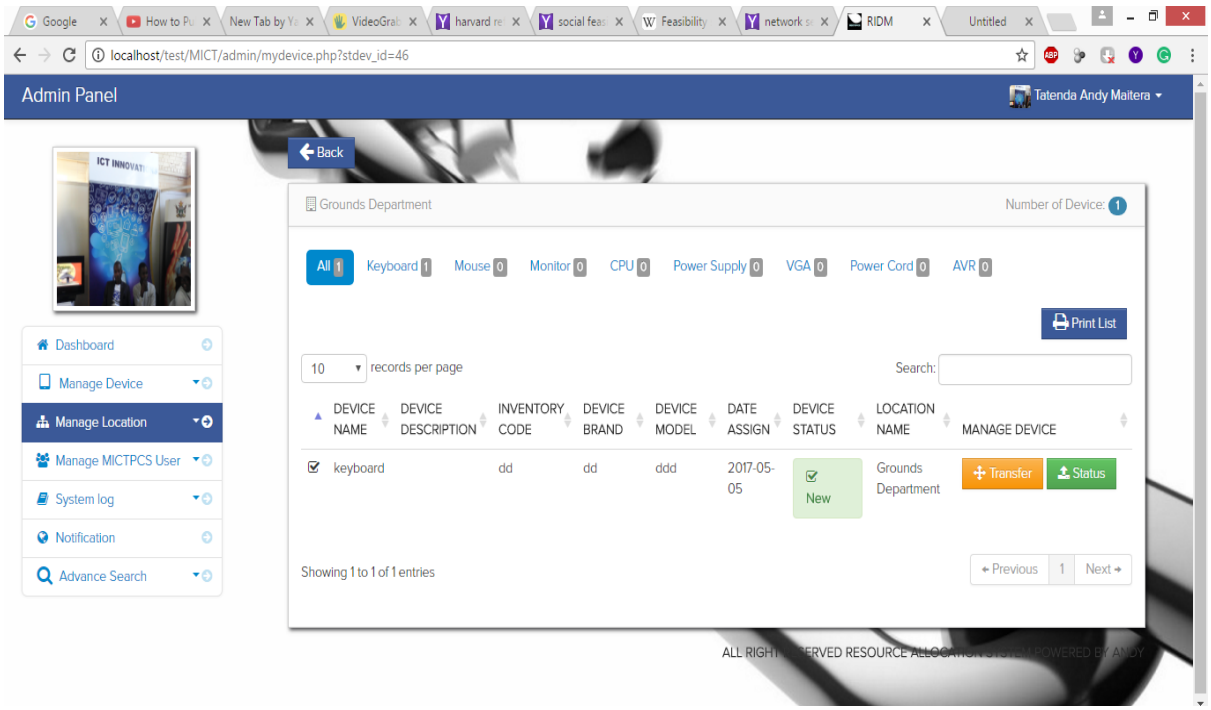

Figure A.5: Decision of status of the resources being allocated

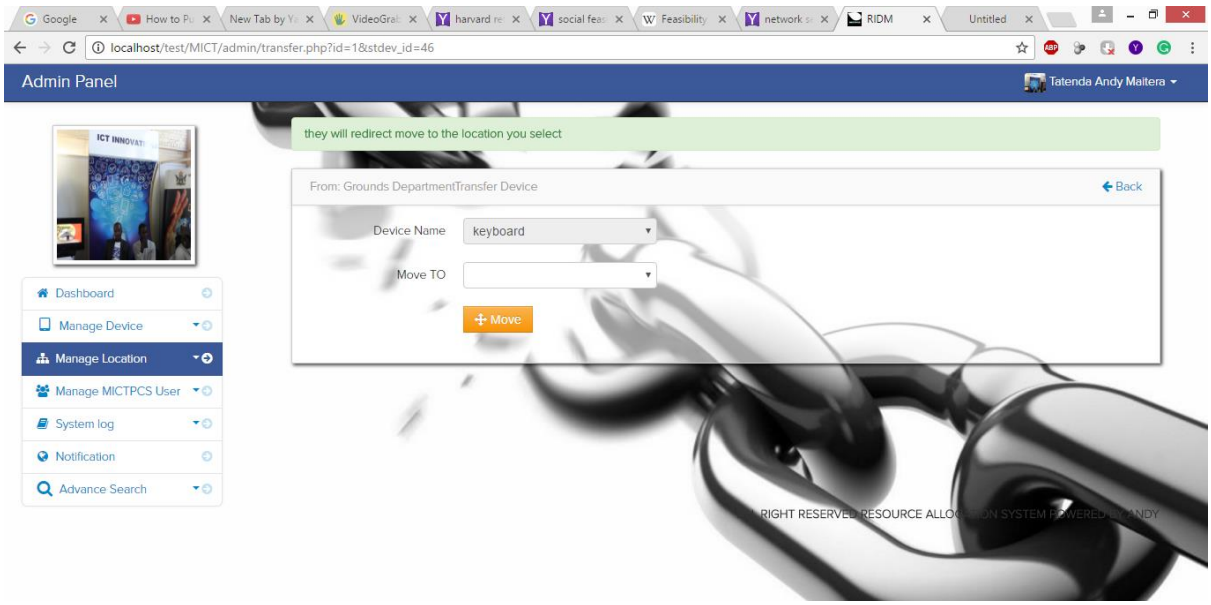

Figure A.6: Transfer of the resources

The figure below shows the activity log .It acts as a security measure into the system verifying any manipulations into the system.

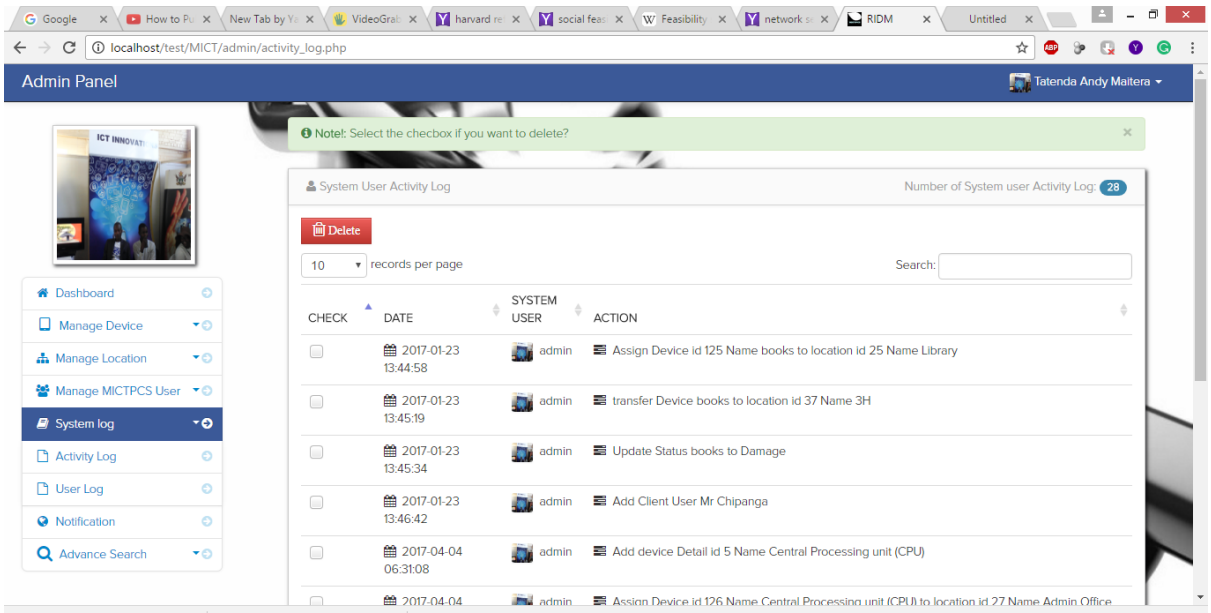

Figure A.7: Activity log of the users

This is the output report of the resources available for print out.

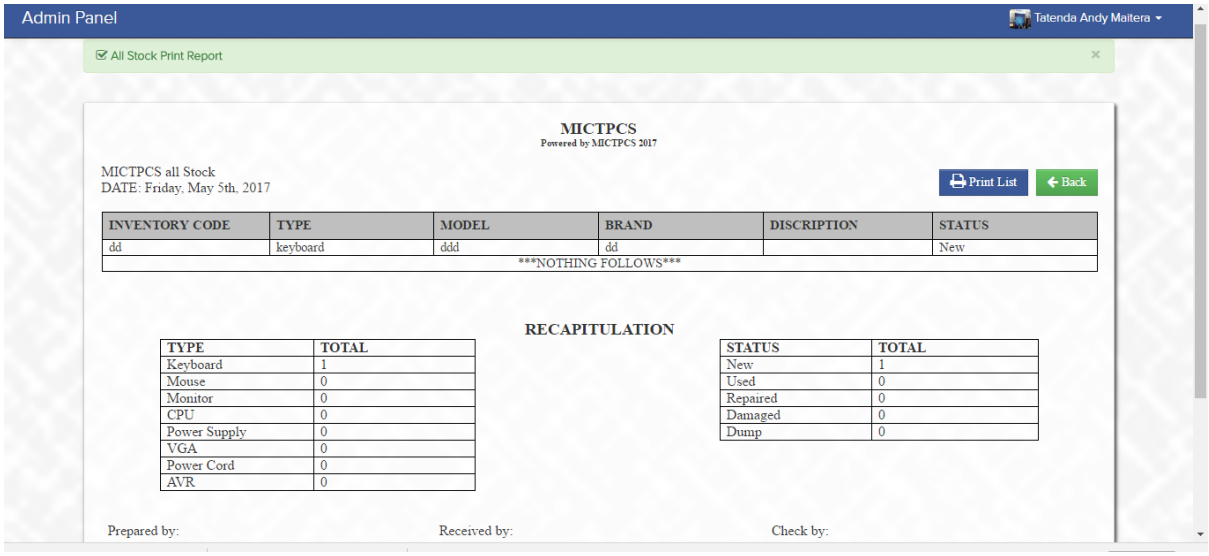

Figure A.8: Report of the system

Appendix B: Interview checklist

MICTPCS Resource allocation system

My name is Andy T. Maitera. I'm studying BSc Information Systems degree (Hons) at Midlands State University. I'm doing a computer project (name mentioned above) which requires a detailed study of the user requirements of the system. So this interview is designed to gather all information pertaining to the system under study.

For each of the questions listed below kindly fill in or tick your response in the spaces provided. Information gathered will be used with the highest degree of confidentiality.

1. How is the resource allocation process carried out currently?

   ……
   ……
   ……

2. Do you think there is need for improving the current system process?

   ……
   ……
   ……

3. What are the challenges associated with using the existing system?

   ……
   ……
   ……

4. What security impactions have been associated with the current system in place, if any, how have these been countered for?

   ……

   ……

   ……

5. Are you satisfied with the investigation and follow-up measures after accidents have taken place ?. If not how can these be rectified.

……

……

……

6. What kind of reports are compiled by the RIDM department and what information is stored within each report? How do these reports assist in coming up with conducive resource allocation system for the organizational?

……

……

……

7. Do you think an online resource allocation system will assist in countering challenges you have identified before?.

   ……

   ……

   ……

Appendix C: Questionnaire for MICTPCS

Introduction

My name is Andy T. Maitera, currently a student from Midlands State University doing a Bachelor of Information Systems Degree. I am in my final year pursuing a research based on the Resource Allocation System in place at MICTPCS. This research will help me to gather information specifically for the research study.

Therefore, I kindly seek your help by completion of the questionnaires which will only be used for this research and information will be kept confidential. The result and recommendation will be openly available for you to see upon the complexion of the research study.

N.B PLEASE DO PROVIDE A TICK WHERE APPLICABLE

Section A: Demographic Data

1. Gender/Sex

Male	
Female	

2. Your Marital Status

Married	
Unmarried	

3. Number of your dependents

Nil	
1 to 2	
3 to 4	
5ormore	

4. Total work experience

Less than 5 years	
6-10 years	
10-20 years	
More than 20 years	

Appendix D: Code snippet

User login

```
<?php //start session session_start();
error_reporting(0);
require_once("functions.php");
require_once ("config.php");
$user = addslashes($_POST['username']);
$pwd = addslashes($_POST['password']);
$query = "SELECT * FROM users WHERE username='$user' AND
password='".md5($pwd)."'";
$conn = mysql_connect($hostname, $username, $userpass) or die("Failed to connect to the
database!");
mysql_select_db($dbname, $conn);
$res = mysql_query($query, $conn); //Query database
if(mysql_num_rows($res) == 1)
{
//Record exists, so login
$row = mysql_fetch_array($res);
$_SESSION['Uname'] = $user;
$_SESSION['Upass'] = $pwd;
$_SESSION['Uid'] = $row['id'];
$_SESSION['name'] = $row['name'];
$_SESSION['sname'] = $row['surname'];  //Redirect to home page
// Form validation
jQuery(document).ready(function()
{
jQuery("#login_form1").submit(function(e)
{
e.preventDefault()
var formData = jQuery(this).serialize();
```

```
$.ajax(
{
type: "POST", url: "login.php",
data: formData, success: function(html){
if(html=='true_admin'){
$.jGrowl("Loading File Wait for a while .....", { sticky: true });
        $.jGrowl("Welcome to MICTPCS)", { header: 'Access Granted' });
        var delay = 2000;

        setTimeout(function(){ window.location = 'admin/dashboard.php'  }, delay);
        }
else    {
        $.jGrowl("Wrong credentials try Again ", { header: 'Login Failed' })
        }
                }
        });
                        return false;
                });
        });
```

Adding resource or devices

```
</form>
<?php
if (isset($_POST['save'])){
$dev_id = $_POST['dev_id'];
$dev_desc = $_POST['dev_desc'];
$dev_serial = $_POST['dev_serial'];
```

```
$dev_brand = $_POST['dev_brand'];
$dev_model = $_POST['dev_model'];
$dev_status = $_POST['dev_status'];


$query = mysql_query("select * from stdevice where dev_serial = '$dev_serial' ")or die(mysql_error());
$count = mysql_num_rows($query);

if ($count > 0){ ?>
<script>
alert('Device Code already Exist');
window.location = "device_stocks.php";
</script>
<?php
}else{
mysql_query("insert into stdevice (dev_id,dev_desc,dev_serial,dev_brand,dev_model,dev_status) values('$dev_id','$dev_desc','$dev_serial','$dev_brand','$dev_model','$dev_status')")or die(mysql_error());
mysql_query("insert into notification (fullname,notification,date_of_notification,link) value('$client_fullname','Add device id $dev_id, Serial Number: $dev_serial',NOW(),'device_stocks.php')")or die(mysql_error());

?>
<script>
window.location = "device_stocks.php";
$.jGrowl("Device Successfully added", { header: 'Device add' });
```

```
</script>
<?php
}
}
?>
```

Allocation of resources