HARARE CITY COUNCIL

VEHICLE LICENSING AND IMPOUNDING SYSTEM

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By

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ABSTRACT

This document outlines the author's practical experiences in a real-life, working environment, within the operational structures of Harare Municipality. It gives a brief background of the organization's history, core business, current operations and future business activities of the City of Harare. The report then outlines the problem definition, research instruments, and significance of the study and justification. The document further details the planning, design and implementation phases of the project.

DECLARATION

I William Mugobogobo do hereby declare, that I am the sole author of this document. If for any reason this document is needed for scholarly research, by students or other institutions, it should be granted.

Signed…………………………….   Date………………………………

APPROVAL

The dissertation by William Mugobogobo, HARARE CITY COUNCIL VEHICLE LICENSING AND IMPOUNDING SYSTEM, is part of the BSc Information Systems Honours Degree, of the Midlands State University and is accepted for its aiding to knowledge and precise presentation.

Supervisor………………….………… Date….………………….………
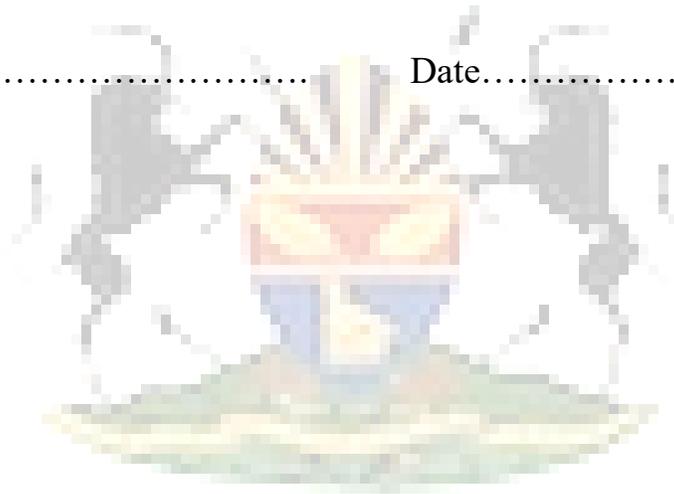
ACKNOWLEDGEMENTS

I thank the Almighty God, for His divine guidance and enablement in allowing me to complete this project. Special thanks go to my Supervisor at Midlands State University, Mr. Samuel Furusa, who tirelessly assisted and gave me guidance throughout the project. It is through your invaluable support and guidance that this project has been made possible.

My gratitude also goes to the Midlands State University lecturers and the entire staff in the ICT Department, at Harare City Council, for giving me the much needed support and encouragement. May our good Lord continue to bless you.

God blessed me with a wonderful family. Thank you for your unwavering support and encouragement. God Bless you and may your experiences be highly fruitful and successful.
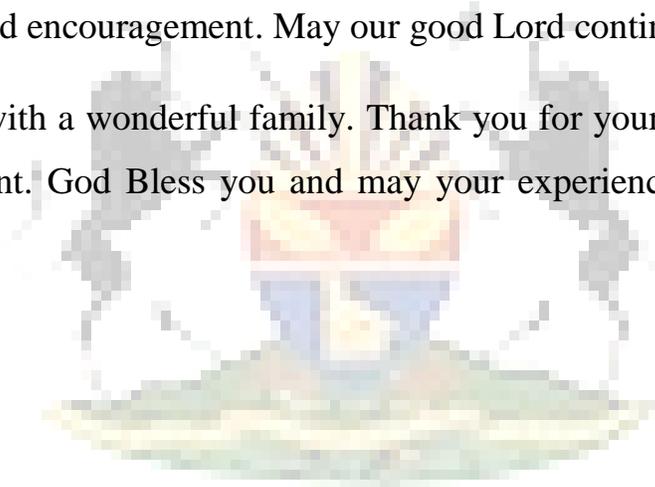
DEDICATIONS

I dedicate this Vehicle Licensing and Impounding System to my family.

FOREWORD

This rich and comprehensive document provides an overview of the hands on experience acquired during the writer's work related learning period at the Harare City Council in an effort to build integration between the institution and industrial practice. Systems development in work related learning was put in place with the primary objective of eradicating problems of graduate students becoming liabilities to industry, where resources are utilized by entities so that the graduate attains practical experience of teachings from University.

This detailed report will emphasize on developing a Vehicle Licensing and Impounding System for the Harare City Council and all the associated functionality of the system. This report was submitted to the Midlands State University in fulfillment of the requirements of the BSc (Hons) Information Systems Degree.
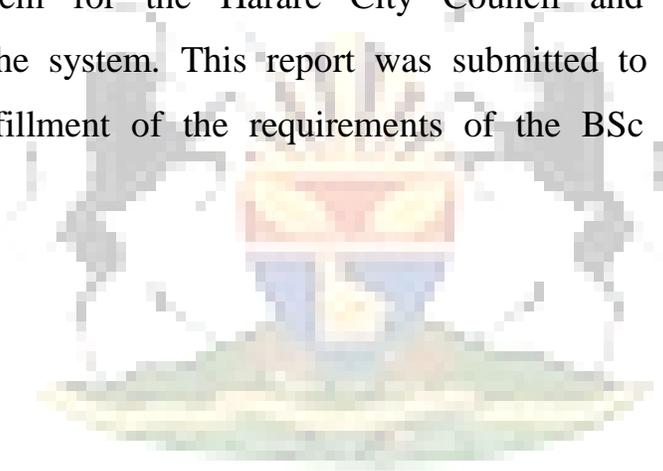
EXECUTICE SUMMARY

This project is on developing a vehicle licensing and impounding system, for the City of Harare, that was done during the third year from June 2015 to December 2015. The purpose of developing the system is to expose, test and apply the theoretical skills and knowledge that the writer acquired during the first two and a half years of the Bachelor of Science Honors Degree in Information Systems. The aim of the project, therefore, is to show the relevance of the theory to practice side and to demonstrate some of the important knowledge that was acquired, to address industry problems and also adequately fit in industry after completion of the degree program.

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LIST OF ACRONYMS

BAT	BUSINESS ACCEPTANCE TESTING
CBA	COST BENEFIT ANALYSIS
DO	DISTRICT OFFICE
DBMS	DATABASE MANAGEMENT SYSTEM
DFD	DATAFLOW DIAGRAM
EMAIL	ELECTRONIC MAIL
GUI	GRAPHIC USER INTERFACE
HCC	HARARE CITY COUNCIL
HRT	HARARE RESIDENCE TRUST
HTTP	HYPERTEXT TRANFER PROTOCOL
ITIL	INFROMATION TECHNOLOGY INFRASTRUCTURE LIBRARY
PRINCE2	PROJECTS IN CONTROLLED ENVIRONMENTS
RAM	RANDON ACCESS MEMORY
REG.	REGISTRATION
ROI	RETURN ON INVESTMENT
ROM	READ ONLY MEMMORY
SIA	SOCIAL IMPACT ASSESSMENT
SQL	STANDARD QUERY LANGUAGE
UAT	USER ACCEPTANCE TESTING
VPN	VIRTUAL PRIVATE NETWORK
WAN	WIDE AREA NETWORK
WWW	WORLD WIDE WEB
ZIMRA	ZIMBABWE REVENUE AUTHORITY

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1.0 Introduction

This chapter outlines the City of Harare's endeavor to make use of current and modern systems in the management of traffic and enforcement of traffic by-laws, within the greater city of Harare. The organizational background and structure will be explained as well as the vision, values, mission and organizational objectives. The aims and objectives of designing a traffic ticketing and impounding system will also be outlined, including the problem definition. Finally the significance of the study, justification for undertaking the project as well as the instruments used will be explained.

1.1 Background of Study

Every organization requires, efficient, modern, automated systems to be put in place to capture, store and process information with limited manual intervention and errors. The Harare City Council's Traffic enforcement Department is currently seized with the increasing influx of traffic in the City and management of traffic, especially the administration of licenses and orderly tracing of public and private vehicles, as well as impounded vehicles in the city. It has therefore, been observed that there is cumbersome manual processing of traffic licenses of both private and public vehicles, especially the administration of public transport vehicles. These are, in some cases, not adequately licensed and operate illegally in the city, posing a threat to the general populace. Current and efficient records of traffic offenses databases, issued tickets, driver and vehicle details are not readily available to efficiently administer the traffic licensing and impounding system for Harare municipality. There is no up-to-date database of all categories of vehicles to effectively check and detect any outstanding revenue from outstanding traffic tickets, before renewing vehicle licenses. The current manual system cannot detect

any previous outstanding tickets and traffic offences, before renewal of licenses, with the Harare City Council. A vehicle licensing and impounding system is a computer system that allows City of Harare to license vehicles, manage licensing information as well as manage impounding facilities. Reasons for City of Harare to hold custody of such vehicles may include but not limited to: un-paid parking or moving violations associated with the vehicle, the vehicle has been employed in the commission of a crime, the vehicle has been involved in a traffic accident, the vehicle has been abandoned, the vehicle has been improperly left in a restricted area, the vehicle has been moved during an emergency, and any other traffic related incidence. A vehicle licensing and impounding system will result in better services to motoring citizens of Harare, increase reporting levels within management, as well as improve revenue collection and fiscal results, for the City of Harare.

1.2 Organizational background

According to the website www.hararecity.co.zw , the City of Salisbury, was founded by a British grouping called the Pioneer Column. Salisbury became a municipality in 1897 and in 1935, Salisbury was given city status. In 1982, the city was christened Harare, as a Local Authority under the Ministry of Local Government and Urban Planning, with a mandate to provide basic services and amenities to Harare residents.

1.2.1 Organizational structure

Organizational structure explains how tasks are grouped and segregated, so that everyone understands their responsibilities to the group McLaughlin (2011). It is a

system used to define the hierarchy within an organization and it refers to the way that people and jobs are arranged within the organization, so that the organization's work can be performed for the attainment of its goals. The organizational structure in figure 1 is a hierarchical structure of lines of authority of Harare City Council, which determine how responsibilities.

CITY OF HARARE ORGANIZATIONAL STRUCTURE: JULY 2014

COUNCILLORS

TOWN CLERK

DIRECTOR: HARARE WATER	HUMAN CAPITAL & PUBLIC SAFETY DIRECTOR	DIRECTOR: CORPORATE SERVICES & HOUSING	FINANCE DIRECTOR	DIRECTOR OF WORKS	DIRECTOR OF HEALTH SERVICES

WATER PRODUCTION	EMPLOYEE RELATIONS	LEGAL SERVICES	BUSINESS DEVELOPMENT UNIT	CENTRAL ACCOUNTS	ENGINEERING SERVICES (ROADS, QUARRY, WORKSHOPS)	MEDICAL SERVICES
WATER DISTRIBUTION	REMUNERATION AND EMPLOYEE WELFARE	COMMITTEES		SUPPLY CHAIN		HOSPITALS
WASTE WATER	CAPABILITY DEVELOPMENT	TRANSPORT	CORPORATE COMMUNICATIONS		WASTE MANAGEMENT & ENVIRONMENTAL REGULATORY PLANNING	NURSING (NUTRITION, HEALTH EDUCATION)
		DISTRICT ADMIN		MANAGEMENT ACCOUNTING	VALUATIONS AND ESTATES	PHARMACY
INVESTMENT AND PROJECTS	HUMAN CAPITAL SERVICES (STAFF OFFICES)	HOUSING	ICT		CITY ARCHITECT	MEDICAL LABORATORY
		SOCIAL SERVICES		REVENUE COLLECTION	CITY PLANNING AND LAND SURVEY	ENVIRONMENTAL HEALTH
QUALITY ASSURANCE	MANAGEMENT SERVICES GROUP	EDUCATION	AUDIT		PUBLIC TRANSPORT & TRAFFIC PLANNING	DENTAL SERVICES
	PUBLIC SAFETY (MUNICIPAL POLICE, TRAFFIC, EMERGENCY SERVICES)	PARKS AND CEMETERIES				EPIDEMIOLOGY AND DISEASE CONTROL
FINANCE AND ADMINISTRATION			MONITORING AND EVALUATION MANAGER			HEALTH SERVICES ADMINISTRATION

Figure 1

1.2.2 Vision

Vision is an organization's aspirations and what it wants accomplish in the medium term or long term future (Scott 1994). It defines what the organization will do in the long term. The City of Harare's vision is an ambitious one which is **"To** achieve **WORLD CLASS CITY STATUS** by the Year 2025".

1.2.3 Values

Values are an organization's compass as well as management's ideals and ethics which they hold dear Demartini (2012). They are referred to and used in decision making, within an organization. They are used both internally and externally to tell those in the organization how things are done and outsiders, on why they want to be associated with the organization.

- COMMITMENT
- TRUTHFULNESS
- INTEGRITY
- TRUST
- AUTHENTICITY

1.2.4 Mission

A mission statement articulates the organization's core ideology, vision and goals, which include core values, which the organization is committed, to pursue to fulfill its mission Abraham (2004). It is provides direction for the organization's stakeholders and value for those outside the organization.

1.2.5 Mission Statement

Harare Municipality enforces traffic and road safeness' through the use of the Vehicle Licensing and Impounding system by mainly:

- ❖ Enforcing of traffic by-laws in the Harare metropolis.
- ❖ Clamping, spiking and towing impounded vehicles that violate traffic by-laws.
- ❖ Control illegal parking of vehicles.
- ❖ Control movement of heavy vehicles from entering the central business district, during business hours.
- ❖ Vehicle licensing and impounding

1.3 Problem Definition

It is a description of what needs to be addressed by a problem resolution team. The Harare City Council's Traffic enforcement Department is currently seized with the increasing influx of traffic in the City and management of traffic, especially the administration of licenses, fines and orderly cramping and storage of vehicles in the city. It has therefore, been observed that there is cumbersome manual processing of traffic licensing and clamping of vehicles, especially the administration of public transport vehicles, which are in some cases, not adequately licensed and operate illegally in the city, posing a threat to the general populace. Current and efficient records of traffic offenses databases, issued tickets, driver and vehicle details are not readily available to efficiently administer the traffic licensing and impounding system for the Harare City Council. There is no up-to-date database of all categories of vehicles to effectively check and detect any

outstanding revenue from outstanding traffic tickets, before releasing an impounded vehicle

In the current system, employees that are not authorized can access, captured and easily altered records. This may easily result in information altering and revenue leakages. A computerized system will thus minimize processing errors. Backups for impounded vehicles, are not available, in the current traditional system and this increases chances of data loss, in the event of a disaster.

1.4 Aims

Develop Harare City Council's computer based vehicle licensing and impounding system that will enable Harare City Council traffic enforcement staff to capture and process traffic licenses and impounding details for vehicle offences in the City.

1.5 Objectives

Objectives are short and medium term goals that an organization aims to achieve. They are concise, time based, measurable actions that support the completion of a goal. Norton (2001).They play an enormous role in developing policies and determining, allocation of resources. City of Harare's objectives are, to provide local governance and allow for a cost effective and affordable infrastructure as well as to have a world class city by 2025.

The system will:

- Save and License vehicle details into the database
- Manage impounded vehicles
- Save vehicle details
- Calculate storage days for impounded vehicles

- Update vehicle status
- vi Account and trace impounded vehicles
- Generate reports for analysis

1.6 Significance of study

The Harare City Council's endeavor to become a world class city by the year 2025, requires that efficient management information and traffic management systems be put in place, for the convenience of the motoring public. An efficient computerized vehicle licensing and impounding system will allow for timeous processing of traffic licenses, whilst providing deterrent measures for traffic offenders in the city. With the increase in the number of both public and private vehicles in the Sunshine City of Harare, the introduction of a computerized vehicle licensing and Impounding system allows for an efficient payment system and accountability of all revenue collected by traffic enforcement officers.

1.7 Justification

The high volume of traffic and subsequent traffic offences in the Metropolis, necessitates the need for an efficient computerized licensing system to process the high volume of traffic related data and transactions. The development of the vehicle licensing and impounding system will increase revenue collection because of increased processing efficiency and accuracy. Accountability and audit trails in the revenue collection processes, will be enhanced as all data will be processed through the new system, which will have audit trails as well as minimal or no manual processing. Computerized capturing and processing of traffic licensing details will also minimize errors in processing of work and increase processing speeds, computerized registration and release of impounded vehicles. Impounded vehicles with outstanding traffic fine amounts will be easily detected by the system

and prevented from being released, until all arrears have been settled. The new system will provide inexpensive storage that does not take up a lot of space, as compared to the current large piles of files and paper work which takes up a lot of space. The system is also affordable and is not expensive to implement, thus saving council valuable financial resources

The Vehicle licensing and impounding system will address challenges associated with licensing and impounded vehicles, as the municipality will be able track and control all impounded vehicle. The system will also calculate storage days for each impounded vehicle. Users will also be trained on how to capture data and manipulate the database system.

1.8 Instruments Used

Research instruments are used to collect information in a qualitative field study or observation. They must be valid and precise as they help to keep track of what is observed and how it is reported. Questionnaires, interviews, observations and reading were used as research instruments for the project.

1.9 Conclusion

The organization's background, history and purpose was outlined in line with its intended vision. The implementation of a computerized vehicle ticketing and impounding system for the City of Harare, would thus improve automation, accountability and move the city, a step closer to its intended vision of becoming a world class city. The following chapter outlines the planning phase.

CHAPTER 2:   PLANNING PHASE

2.0 Introduction

It is part of project management, which involves the use of Gantt charts and other tools for planning and reporting on progress Helderman K. (2001). The primary document, in this phase, is the project plan, which communicates project activities, such as tasks to be performed. Definition of project scope is done in this phase and also involves an evaluation process to determine if it is worthwhile to embark on the intended project. It also identifies the value of the system to the business, the associated business needs that will be addressed, system functionality and feasibility.

2.1 Reasons for developing a new system

The current system has cumbersome manual processing of licenses and traffic fines for all categories of vehicles, especially the administration of public transport vehicles, which are in some cases, not adequately licensed and operate illegally in the city. Current and efficient records of traffic licenses, offenses databases, issued tickets, impounding details, driver and vehicle details are not readily available, in the current system, to efficiently administer the traffic licensing system for the Harare City Council. There is no up-to-date database of all categories of vehicles to effectively check and detect any outstanding revenue from outstanding traffic licenses and tickets. The current manual system cannot detect any previous outstanding license issues, tickets and traffic offences, before releasing vehicle from the impounding warehouse.

The development of a Vehicle Licensing and Impounding system for the Harare City Council is a critical requirement to ensure that the business processes in the traffic enforcement section are adequately computerized. The reasons for developing the system are to computerize the licensing of vehicles and impounding of vehicles involved in traffic related offences, within the metropolis, maintain a centralized database of all traffic offences committed in the City and efficiently manage records of all impounded vehicles, at the City of Harare vehicle storage warehouse. The City Council needs to detect all unlicensed vehicles, follow-up and collect all outstanding revenue through an effective debt management system, maintain up to date records of all impounded vehicles and also generate statistical, analytical, ad-hoc and periodic traffic related reports from the new system. Employee overtime will be reduced by installing and automating the processes, which will in turn improve efficiency. Revenue collection will also increase due to improved employee performance through increased productivity and efficiency.

2.2 Business Value

Businesses are unable to realize expected results from their information technology investments due to, lack of effective planning, implementing and evaluation processes Kohli (2004). Implementing a vehicle licensing and impounding system, will bring immense value to the City of Harare, if properly developed and implemented. It will among other benefits, increase revenue collection, as well as improve efficiency, within the organization. It will also automate previously manual operations, such as vehicle impounding warehouse management, efficient follow-up of unlicensed vehicles and detection of unpaid tickets.

The organization will provide improved service delivery to its motoring public by providing easy access to vehicle and licensing information online, through a web

interface, on any device that has an internet connection. This will improve and enhance the image of the organization as well as provide online channels for the motoring public to interface with the City of Harare, when making inquiries about their vehicle status that may have been impounded.

2.3. Feasibility Study

Feasibility study examines the viability of a project and attempts to identify potential problems, before committing resources to a project, Overton (2007). The feasibility study helps decision makers or management to make an informed decision on whether or not to proceed with the project. It also determines if the system will bring benefits to both the organization and end users, and gives an indication to proceed to the next phase of the project. A feasibility study, that includes technical, economic, social and operational feasibility, was done for the project in order to expose the benefits of implementing a Vehicle licensing and impounding system and project as a whole.

2.3.1 Technical Feasibility

Technical feasibility is evaluating if current technical resources, within the organization, are adequate and also evaluates hardware and software requirements to determine feasibility, Thompson (2005).

Technical feasibility refers to the attainability of the proposed system using the technology that is currently in existence. It takes into account the technology, manpower and skills that are required and are currently available. In this study the technical requirements for the project were considered and were then compared to the technical capabilities of Harare City Council. In the analysis carried out it was discovered that the internal technical skills are adequate.

The current information technology staff which comprises of project management experts, programmers, analyst programmers, systems analysts and developers were evaluated to ensure that they possess the correct skills to successfully carry out the project to completion. The organization also has readily available, internal skills in C#, visual basic programming, Microsoft SQL Server, Windows server operating system, systems analysis and design, networking, Web design, internet technologies, hardware repairs and maintenance.

City of Harare Information Communication department also has personnel who are certified in CISCO networking products, Information technology infrastructure library (ITIL), Projects in controlled environments (PRINCE2), Microsoft certified system engineers (MCSE) and Microsoft certified database administrators (MCDA). The available internal technical skills are therefore, adequate to ensure feasibility of the project.

HARDWARE	
Server	Hewlett Packard Server with minimum 4Ghz processor, 4GB RAM, 1Terabyte Hard Disk space, color monitor, keyboard, 100/1000 Network interface card, color monitor, keyboard, mouse, CD / DVD ROM Drive, 2Kva Uninterruptible power supply unit
Client	
	Hewlett Packard desktop computers, with minimum 2GB RAM, keyboard, mouse, 10/100 Network Interface Card, Color monitor 500GB hard disk drive
SOFTWARE	
	Microsoft Windows Server 2012 Operating System, Windows 8.1 client operating system, Microsoft Office 2013 professional, Microsoft Exchange Server 2012, Eset antivirus software, Microsoft SQL 2012 Server software, Microsoft Visual Studio, Dreamweaver
NETWORK	
	CISCO Router 2901, CISCO Core Switch, Cisco 5505 Firewall,

	Fiber media convectors, Fiber connection, 48U network cabinet, 48 port CISCO network switch

Table 2.1   Hardware and software requirements

2.3.2 Operational feasibility

It is an assessment of how the proposed system, solves problem at hand Milton, (2014). It also establishes the organization's level of support for the proposed system. The organization's management pledged to take ownership and fully support the project materially and financially. They highlighted the potential benefits and impact of the system, in increasing accountability and revenue collection for the City. The proposed project's objectives therefore, fits in very well with the business requirements and ultimate goals of the city of Harare, to become an efficient and world class city by the year 2025.

Users of the system are fully in support of the system, as they indicated that the new system will reduce manual processing of work and make their tasks much easier through computerizing their work. User are therefore willing to be involved and take ownership of the project, which is one of the critical success factor in the project. The proposed system will improve existing business processes and make processing of work more efficient, enhance reliability, will be easily maintained and is very affordable, considering Harare City Council's financial constraints. Operational feasibility is also, primarily dependent on available human resources that will be involved in the proposed project and weather they will be able to fully utilize the system, once it is implemented. It determines how the proposed system is able to address the existing organizational problems as well as taking advantage of any available identified scoped opportunities. It also looks and evaluates if the

identified organizational requirements that were identified can be adequately fulfilled and satisfied. The combined factors of management buy-in and commitment as well as user acceptance makes the operationalization of the system very feasible.

2.3.3 Economic Feasibility

It determines the positive economic benefits to be realized in an organization, Murphy (2002). Justification of large scale projects, usually require financial evaluation and this, in turn requires monetary estimates of the cost and benefits to be derived. It involves the identification and quantification of all expected benefits. Both tangible and intangible benefit of the proposed system to the organization were considered and carefully evaluated.

Development Costs

Development costs are any expenditure that is incurred from the beginning of a project to its conclusion. These include software, hardware acquisition costs, training staff costs and any other costs that are incidental and related to the project.

	2015	2016	2017	2018	4 Year Total
	US$	US$	US$	US$	US$
Costs					
Microsoft SQL Server Database	3,000	1,500	0	0	4,500
Microsoft Visual Studio	2,000	0			2,000
Microsoft Windows 8.1 Operating System	4,000	2,500	0	1,000	7,500
Net Cash for Software	**9,000**	**4,000**	**0**	**1,000**	**14,000**
Software Maintenance & Upgrades	2,500	2,500	1,000		6,000
Hardware and Maintenance	5,000	2,500	1,500	2,000	11,000

Training and Consulting	8,000	2,000	1,000	1,000	12,000
Networking	3,500	3,000	2,500	2,000	11,000
Total Hardware / Software Maintenance	**19,000**	**10,000**	**6,000**	**5,000**	**40,000**
Finance and Staff Costs	7,000	4,000	2,500	2,500	16,000
Stationery	3,000	2,000	1,000	500	6,500
Total Staff and Stationery Costs	**10,000**	**6,000**	**3,500**	**3,000**	**22,500**
TOTAL Develop & Implementation Costs	**38,000**	**20,000**	**9,500**	**9,000**	**76,500**

Cost Benefit Analysis

Cost benefit analysis (CBA), is a technique for assessing cost and benefits of a capital investment project, over a given time period Riley (2012). It can also be said to be an estimation and evaluation of net benefits associated with alternatives for achieving defined goals of the business. It is the primary method used to justify expenditures and is also a critical piece of the business case and is a comparison of the total cost of each option, against the total expected benefits. A cost benefit analysis (CBA), was therefore, done to estimate the strengths and weaknesses of alternatives, which satisfy activities of the business.In the analysis which was carried out, it was determined that the organization has the financial capacity and resources available, that were allocated to enable successful implementation of the entire project. Resources were made available for both software, hardware, human resources and all project needs.

Tangible and intangible benefits

	2015	2016	2017	2018	Total
Tangible benefits	US$	US$	US$	US$	US$
Increase revenue collection	180,000	204,000	252,400	324,160	1,426,560
Reduce Debtors	205,000	180,800	126,560	101,248	103,752
Reduce Labor Costs	52,000	68,000	79,400	96,770	44,770

Reduce Overtime Expenses	84,000	67,200	34,540	19,200	64,800
Improve processing efficiency & stationery usage	72,000	50,200	45,102	47,104	26,898
Total Tangible benefits	**593,000**	**578,700**	**543,100**	**586,480**	**2,301,280**

	2015	2016	2017	2018	Total
Intangible benefits	US$	US$	US$	US$	US$
Customer Satisfaction	35,000	71,000	98,000	102,300	306,300
Improved Organizational Image	20,000	78,000	99,300	110,520	307,820
Improve Management Decision making	40,000	96,000	140,400	221,690	498,090
Improve Employee morale	10,000	46,000	58,300	91,480	205,780
Total Intangible Benefits	**105,000**	**291,000**	**396,400**	**525,990**	**1,317,990**

	2015	2016	2017	2018	Total
Total Tangible/Intangible Benefits	**698,000**	**869,700**	**939,500**	**1,112,470**	**2,518,770**

Table 2.3   Development costs

Return on investment (ROI)

Return on investment (ROI) is a performance measure used to evaluate the efficiency of an investment Blanchard (2011). ROI was calculated by dividing the total benefit by the cost of the investment and the result was expressed as a percentage.

ROI = $\quad$ Total benefit $\quad$ * $\quad$ 100

$\qquad$ Total cost

= $\qquad$ 521,164 $\quad$ * $\qquad$ 100

$\qquad$ 114,000

= $\qquad$ **457.16%**

Comment

The Return on investment for the project, expressed as a percentage is very favorable as the total return is very high, amounting to 457.16%

2.3.4 Social feasibility

It involve evaluating the compatibility of cultural and social practices, beliefs and status affected by the proposed project. A social impact assessment (SIA) was done to come up with a framework to prioritize, gathering and analyzing of social information and stakeholder participation in the delivery of the project. A plan was developed to involve all affected public and private stakeholders through an extensive consultative program and advertisements in the print and electronic media. All concerned were asked to submit their input and proposals on how they think the management of licensing and impounding of vehicles was going to affect them, as well as any suggested improvements. The motoring public was fully in support of the project as they felt that the new system will bring transparency to council's traffic department and enable them to have full information about their vehicle licenses and impounded vehicle status.

The Government through the Zimbabwe Revenue Authority (ZIMRA) and Ministry of Local Government and Public Housing, will also be able to collect

revenue that is realized from an efficient system, thereby availing money for further social programs that benefit the people. Collected revenue from the new system, will also enhance service delivery by council, through improved water purification, public lighting and maintenance of road infrastructure.

2.4 Risk analysis

It is a process of analysis and taking appropriate steps to reduce associated risk, so that it is kept at an acceptable and manageable level, Vose, (2008). Even the best planned project can have uncertainties or unforeseen events occurring, if proper planning and care is taken. It is therefore important that a risk analysis exercise, be carried out before commencement of the project, to prevent the project from not delivering. Risk must therefore, be either prevented from occurring or managed to ensure that the project is not adversely affected. The process of analyzing risk is also a continuous process, during the project, whereby possible risk areas are access, detected and resolved.

The risk analysis that was done considered all the factors such as what could possibly go wrong before and during the project, as well as the probability or likelihood of something going wrong. These factors were then evaluated to determine how they can affect the project and its delivery, as well as what can be one to mitigate the identified problems.

2.5 Develop Work Plan

It is a set of goals or outline by which project goals and objectives are achieved. It involves breaking down the various project tasks into smaller manageable tasks, while identifying and focusing on what needs to be achieved.

Activity	Duration (in days)	Start	Finish
Project Proposal	18	5/06/2015	30/06/2015
Planning Phase	16	03/07/2015	17/07/2015
Analysis Phase	21	18/07/2015	14/08/2015
Design Phase	35	13/08/2015	30/09/2015
Implementation phase	10	01/10/2015	14/10/2015
Maintenance		14/10/2015	
Documentation		05/06/2015	14/10/2015

Table 2.4   Work Plan

Gantt chart

TASKS / DAYS	18	16	21	35	10	
Proposal	■					
Planning Phase		■				
Analysis Phase			■			
Design Phase				■		
Implementation					■	
Maintenance						■

Table 2.5   Gantt chart to show time allocation for overall project

2.6 Conclusion

It has been determined and justified, why the project should be undertaken and its associated benefits to the organization. The feasibility study carried out also revealed that the project is feasible and can be achieved with the available resources and effort. Risk analysis, risk detection and mitigation techniques were outlines as well as the project work plan and specific timelines. The next chapter looks at the analysis phase of the project.

CHAPTER 3:   ANALYSIS PHASE

3.0 Introduction

The analysis phase may be equated to a journalist's interview as it considers the user, what the system aims to accomplish and the specific timeframes Rainer (2011). System analysis is a process of gathering information about the current situation and then recommending possible improvements. This chapter discusses information gathering methodologies that were used, such as questionnaires, interviews, observations and document review. It also discusses the current system and highlights its weaknesses as well as available alternatives. Lastly requirements analysis is discussed and then conclude the chapter.

3.1 Information Gathering Methodologies

This is a mandatory prerequisite for an exhaustive appreciation of Harare City Council, for accurately determining the system. The purpose and aim of this stage was to obtain comprehensive information from the current environment and system users. This in turn integrates the opinions and ideas that are obtained into the design phase. This exercise uncovered more user necessities and limitations of the current system and the fact finding techniques that were used in this project phase,

are interviews, questionnaire and Surveys, observations, document reviews and focus groups

3.1.1 Observation

Observation is the process of actively gathering information from a selected person, area or activity of interest, with the primary objective of gaining a better understanding of the reality or current operations Collins (2010). Observations were carried out in the various sections, within the City of Harare's traffic enforcement department to determine and establish the current way of doing work. Observations were specifically done as they are a noble methodology which permits the observer to comprehend the current system as it functions in the real world situation. Direct observations were therefore, used to gather required information.

Observation advantages

- Analyst can quickly understanding of how the system
- Complicated tasks are easily described in words
- Work measurements can be easily done
- Minimal or no interference with work of those being observed
- Useful where there is no proper documentation for current system
- Easy to spot inefficiencies in current system
- Less costly compared to other fact-finding techniques.

Disadvantages of Observation

- Not very efficient at capturing quantitative data for analysis
- Activities varied on different days resulting in incorrect observations

- Produced biased results and conclusions.

  - Tasks observed were also subjected to various types of interruptions.

- Some users were not comfortable being watched while working and therefore, performed differently, thus generating false results.

- Demanding in terms of personal commitment, time and effort

Observation findings

The observations done showed that the current system is cumbersome, manual and slow, which usually leads to users spending more time to complete tasks. A lot of paperwork is done at the traffic enforcement department, and also files are stored in cabinets and thus sometimes makes it very difficult to find information on vehicle or customer contact details. Long customer queues were observed as they waited to be served, causing customer dissatisfaction by the long waiting times. Processing and writing errors were also observed due to human error as well as errors in reconciling cash received with actual documented invoices. Data is not well secured as it is stored in open, unsecured office cabinets.

3.1.2 Interviews

An interview is a method of data collection, information or opinion gathering that specifically involves asking a series of questions Wertsch (2009). It is a direct conversation for soliciting information through face to face interaction, between the interviewer and the interviewee. The interviews were done to ascertain and understand how the current system works as well as to solicit ideas from the users

on how they want their work improved by the system. Interview were carried out in difference offices, among internal stakeholders at Harare City Council, such as key users of the system and management staff as well as the external customers and stakeholders. These were planned and done in a period of ten working days.

Specific and strategic key questions were gathered and properly structured for maximum effectiveness. Likely answers from interviewees were predicted and a plan for follow up questions was made to elicit more details, were required. Appointments were made with the affected people to advise them of the interview date and place, as well as the purpose of the interview. During the interviews, interviewees were encouraged to come up with open answers that were not covered by questionnaires and also elaborate on specific details that they wanted to highlight. This enabled the interviewer to gather opinions on the current system and broader issues such as how the system will impact other parts of the entire organization. Both structured and unstructured questions, were therefore, used in this exercise.

Advantages of interviews

- Allow for personal contact and understanding the interviewee, user or customer as opinions were aired and considered during the interview.
- Allowed for interpretation of non-verbal communication and elicited hard to quantify information.
- Greater accuracy was acquired as there was easier clarification of key areas
- Interviewer planned questions ahead of time, before the interview and received immediate responses during the interview.

Disadvantages interviews

- Interview was only practical for a limited number of interviewees

- Was time consuming and took up a lot of time for both the interviewer and interviewees.

- People had to take time from work and be available for the interview thus sacrificing a lot of productive working time.

- It was difficult for traffic enforcement staff, to find time off, for interviews, as interviewed were conducted during the busy license renewal period.

- Good questions were difficult to formulate and some of the data obtained was biased towards the views of the interviewee.

- Some interviewees were reluctant to give information and were less willing to say the truth as the interview was not anonymous.

Interview findings

Interviews were conducted on Harare municipality system users, management, traffic officers and general motorists to elicit their responses. Users were not happy with the manual system as it took them a lot of time and effort to complete tasks. Errors were always occurring because human effort is prone to errors than a computerized system. Management were unable to get timeous, ad-hoc, summary and detailed reports from the system with minimal effort. Revenue collection figures were not readily available to aid management in decision making. Management often had to make educated guesses, without adequate accurate information from available information.

Creditors and outstanding licenses and payments are not easily obtained. The manual system can easily be manipulated by experienced users, thus loosing

revenue and prejudicing council. Customers and clients are always complaining about long queues and poor service due to the time it takes to complete serving clients using the manual effort. Motorist were therefore happy about introducing a new efficient system. A lot of money was being spent by the City of Harare to pay employees overtime, due to long extra hours that are worked in order to finish and consolidate work. Staff motivation and morale was very low due to the cumbersome way of processing work. Management were also happy that they would also get timeous and accurate information for decision making.

3.1.3 Questionnaire

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents Galton (1909). A questionnaire is mainly used as a research instrument to gather required information that can be used to achieve desired aims and objectives. Questionnaires used were both closed simple questions, including relevant multiple choices, to enable the respondents to easily and clearly answer the questions, as well as open ended questions, which allowed for more detailed responses to be provided. These open ended questions were however, more difficult to analyze than closed questions and some of the responses were not very useful for the subject matter.

To ensure that the questionnaire were effective and served its purpose, the type of questions were carefully considered and the majority of questions were closed, to allow for effective data analysis, although some questions were open ended. The number of questions were tailored not to be too long to elicit and generate interest

from the users and the wording of the questions was also carefully done to eliminate ambiguity. The media that was used was considered and questionnaires were sent electronically via electronic mail (email) and others were printed for those that are not on email. Printed questionnaires, however, took more resources and time to produce. Privacy of respondent was also considered to determine if the respondents were to respond to the questionnaire anonymously. This is due to the fact that respondents usually give an honest responds if they know that they will not be identified or victimized. Respondents therefore, answered the questionnaires more openly expressing their views since they were made to be anonymously filled. Respondents had time to consider their responses before writing them down and this provided reliable data. Questionnaires were distributed at once to various people, thus saving much needed time and money.

Questionnaire advantages

- Convenient for recipients as it allowed respondents to give answers at their own pace without being rushed and allowing them to give comprehensive answers.
- Allowed for anonymous inputs and therefore, produced precise information
- Reduced bias as everyone answered the same questions.
- Questionnaires were distributed to many respondents concurrently
- Were easier to arrange and conduct as compared to interviews as there was no personal monitoring.
- Confidentiality and anonymity was maintained which enhanced, chances of getting genuine responses
- No room for intimidation by anyone
- More data for analysis purposes was provided, as standardized answers were supplied, thus making the analysis more thorough and accurate.

- Responses were obtained simultaneously over a short space of time.

Questionnaire disadvantages

- Questionnaires are impersonal and people tended to be more open during face to face discussions, thus spending more time to complete the questionnaires

- Pre-coded answers seemed frustrating for respondent, thus deterring them from answering.

- Questionnaires were time consuming, to answer, as the response was not immediate, as in the case with interviews.

- The return rate did not match the number of questionnaires handed out and incomplete or poorly completed answers, in some instances, were provided, as it was difficult to expand on closed questions

Questionnaire findings

Questionnaires were distributed to Harare City Council system users, management, motorists of both private and public vehicles, Harare city councilors and representatives of the Harare Residents Trust (HRT). This allowed for anonymous input and therefore produced precise information in some instances. There was consensus among the people who responded to the questionnaires that the current system is slow and leads to loss of much time and effort. Searching for files which contain required information on customers and vehicles takes too long. Valuable and accurate information was obtained due to the anonymous nature of the questionnaires and more respondents were able to respond on time as users wanted a change in the way they are currently working. A seventy eight (38%) percent response rate was realized for the questionnaires.

3.1.4 Document review

Document review is a way of collecting data by reviewing existing documents. The documents may be internal to a program or organization or may be Kellog Foundation (1998). Documents may be hard copy or electronic and may include reports, program logs, invoices, receipts and traffic tickets. Document review involves the review and scrutinizing of current documented business processes and available workflow documents. It is used to understand how data flows through the City of Harare as an organization, that is how it is gathered, captured, collated, manipulated and then reported to all levels within the organization. Input, output documents and reports produced from the current system were therefore, carefully examined. Documents and areas that were examines are; data/customer collection forms, Records, Invoices, receipts, formal reports, calendars, vehicle registers and traffic tickets.

Document review advantages

- Good for tracking dataflow, data types and formats
- Analyst obtained accurate information on how procedures were documented.
- Assessment of the existing systems strengths and weaknesses done by reviewing output documents, without bias
- Provided solid evidence that cannot be changed and allowed for efficient tracking of inefficient dataflow

Document review disadvantages

- Cannot capture the efficiency of processes, such as processing speed or delays that occur
- Could not assist is understanding how people actually used the data

- Had no flexibility to question errors that were made on some of the classified documents.

3.1.5 Information gathering overview

Interviews, questionnaires and observations were used to determine and establish how people used the system and document review was used to determine how data flows within the organization. After all the methods were used it was discovered that the questionnaire had low response as compared to the other two methods of which observation and interviews had well validated, summarized information supported by record sampling.

3.2 Analysis of existing system

Current system analysis is an important source for user requirements determination. From the information gathered from various information gathering techniques outlined above, the description of the current system is outlined below.

3.3 Description of current system

Customers make payments for licensing their clamped or impounded vehicle. A cash receipt is issued when payment is received and proof of payment can then be produced for release of clamped vehicle, from the vehicle warehouse. Receipting officers receive cash for vehicle license renewals that are done once a year, by public transport owners, in order to be allowed to operate. The system is however, not able to search the database and detect if the vehicle license has been paid. It is also unable to determine if impounded vehicle has outstanding traffic offence tickets before it is released, to the owner.

3.4 Data analysis

Data analysis involves the systematic application of statistical and logical techniques, to evaluate data and available information Modell (1992). The study population, for which the results and conclusion are based are mainly the City of Harare employees, private motorists or vehicle owners, who utilize City of Harare parking and road infrastructure as well as public transport, kombi owners. Executive, middle, lower management as well as shop-floor employees, within the traffic enforcement and related departments, were interview, observed while working and also responded to prepared questionnaires. Out of the 550 traffic enforcement employee interviews, 90% participated and responded positively to the proposal for a new system. Out of the 100 traffic enforcement employees, 9 senior level management staff were interviewed and 8 middle level managers were interviewed, making a 100% participation and response rate from management.

Private motorists are vehicle owners, use City of Harare parking facilities, in the central business district and are charged, parking fees on an hourly basis. They also receive parking tickets for parking and traffic related offenses that are that are committed within the city, from City of Harare traffic enforcement officers. From the analysis carried out it was established that the estimated population of registered vehicles, for the city of Harare is 400,000 out of a total vehicle population of 650,000. A total of 76.6% of the vehicles are therefore registered, while 43.3% are unregistered. The City of Harare has a total of 9,580 public transport vehicles (kombis), that are registered in the City Council's database, out of a total of 14,000, which are operating in the city. 78.5% of the kombis are therefore, registered with the city of Harare and 39.8% of the kombis are operating illegally. Annual permit fees for a standard kombi with a carrying capacity of 14 people is US$110 inclusive of value added tax. The expected total annual revenue that is generated from registered kombis is US$ 922,000 (9,220 * US$100), out of

a possible US$ 1,300,000, if all kombis were registered. A total of US$ 388,000 which constitutes 34.5% of total expected revenue is lost through unregistered kombis that are operating illegally.

City of Harare has a total of 7,500 public parking bays that are open for daily use to the public, from 8am to 5pm in the evening, at an hourly payment rate of US$1 per hour. There are a total of 9 hours that are chargeable for parking every day, for each vehicle and this includes the Samora Machel Avenue and Julius Nyerere parkades. If all the 7,000 parking bays are fully utilized for a maximum of 9 hours per day, the total daily revenue potential is US$ 83,000. On Saturdays parking is charged from 8am to 1pm and Sunday is free parking. Total potential weekly revenue from parking is therefore US$380,000. Potential monthly and annual revenue collections from parking bays, is US$ 1,800,000 and US$19,800,000 respectively.

3.4.1 Process analysis

Process analysis is an organized way of decomposing stages of a process that is used to deliver inputs, output and operations that take place during each project phase   Alwin (2000). Analysis of the current system can, be conducted by doing an in-depth review of how the system is being used within the City of Harare. This is done by detailing inputs, processes and outputs.

Inputs
➢ Client information
➢ Vehicle information
➢ Warehouse details
➢ Traffic offence

> Amount paid

Processes

> Create client record

> Create details

> Accept payment

> process receipt

> Process vehicle release from warehouse

> Reports

Output

> Payment receipt

> Financial reports

> Customer and vehicle reports

> Warehouse storage reports

3.4.2 Context diagram of current system

According to Kendal (2002), a context diagram describes boundaries of the current system and outlines the degree to which the system is related to the external environment.

CONTEXT DIAGRAM

Manual update of fines

| Client | | Traffic Officer |

Receipting

City of Harare, Licensing and Impounding System

npounding System
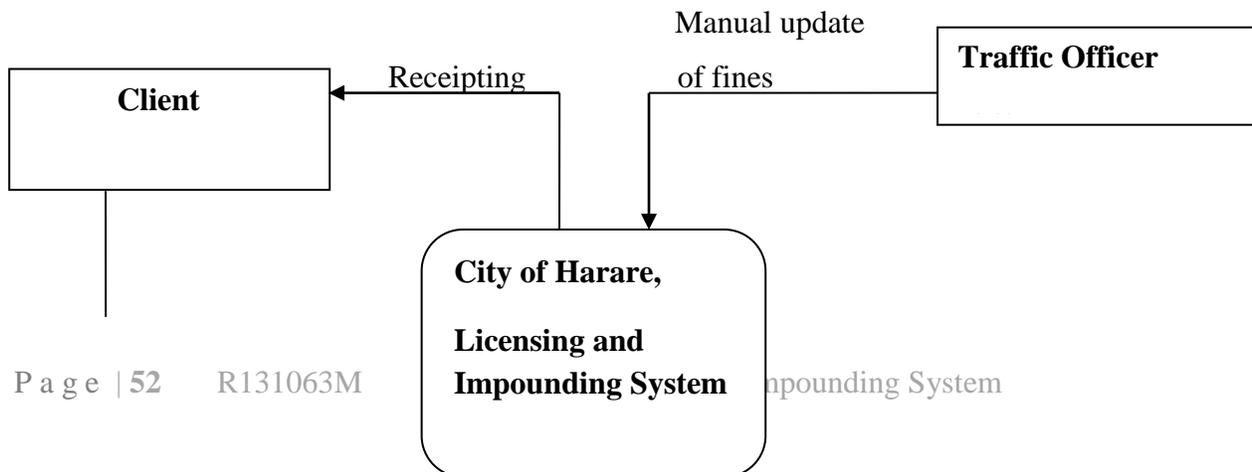
Submit licensing details

Update details

Manual Inquiry

		Administrator / Traffic Superintendent / Traffic Office / Licensing Officer

Licensing Rates

reports

Licensing Officer

Figure 3.1

Key

Entity

→ - Dataflow

Process

DATAFLOW DIAGRAM

ADMINISTRATOR	→	**P1** Create System users	→	D1	User Database

License Application

CUSTOMER	Bill →	**P2** License vehicle	→	D2	Licensing Details

		P3 Pay for License	→	D3	Payment Details

Return Payment Receipt

Licensing Officer		**P4** Update License Database	Update	D4	License history

Update Transactions

License Current

Traffic Officer	License Inquiry	**P5** Check License Details	Inquire	D5	Inquiry details

License Expired

Figure 3.2

3.5 Weaknesses of the current system

The current system has no backup facility as a manual system is in use. It is very difficult to retrieve information quickly and the response time to resolve customer queries, is very due to manual processing and searching of work. A lot of processing errors occur, which result from duplication of transactions, as a result of manual processing efforts. The system uses a lot of paper, and very high storage expenses are incurred, due to storage of large volumes of paper records. It has inadequate security controls and audit trails.

3.6 Alternatives

Outsourcing, improvement and development are the three available options for the City of Harare Traffic enforcement.

3.6.1 Outsourcing

Outsourcing is transferring some of an organization's internal activities to outside providers, through a contract Greaver (1999). This involves contracting an external consultant to develop the system or be part of the development team.

Advantages

- Outsourcing allows the organization to free internal resources for other more important work.
- Brings external skills that may not be available within the organization.
- System improvements can also be done and bring about new ideas and ways of processing work
- New and innovative ideas can be brought into the organization by third party consultants

Disadvantages

- Outsourcing can be very costly to the organization as a lot of money is paid to external vendors.
- External consultants may not be willing to transfer skills to internal staff.
- Organization becomes heavily dependent on external consultants for support.
- Outsourcing is risky to organizational business continuity.

- External consultants may not understand the organization's processes, for them to fully comprehend user requirements and produce a good system.

3.6.2 Improvements

This involves enhancing the current system to make it more user, customer friendly, more efficient and usable. It is however, difficult in the current circumstances to improve a manual system to make it more efficient, secure, user friendly and customer friendly.

Advantages

No benefits can be derived from improving the current manual system.

Disadvantages

The current system is complicated and has no adequate support from vendor companies. It is also difficult to customize and improve, as it uses old and outdated technology. Manual processing causes a lot of human errors and opens the system to manipulation.

3.6.3 In- house development

It is using internal organizational resources, to design a new system. The following benefits will be realized;

- Users will have system ownership, as system specifications are based on user requirements during system development.
- City of Harare, will continue to build its employee skills base, through in house development and training.

- There will be readily available support from internal staff members who have knowledge of the system.

- In house development will save a lot of money.

- Users will actively contribute to the development of the system and solve unique user requirements.

Disadvantages

- It is time consuming.

- A lot of in-house training is required

- A lot of financial resources are required to develop the system

3.6.4 Alternative selection

In-house development of the system has the potential of satisfying unique user requirements and reduce dependency on external vendors.

Alternatives for in-house development were chosen to ensure that:

- Internal upgrades were done when needed.

- All user requirements and specifications were included in the new system.

- Cost are reduced

3.7 Requirements Analysis

Requirements analysis includes activities that determine the conditions that must be met for a new Meilir (1980). The process involves all stakeholders, such as those who will benefit as well as the users. Requirements analysis important to the success of a project and must be actionable, measurable, and testable.

3.7.1 Functional Requirements

Functional requirements contain a detailed breakdown which outlines how the outcome of a project will operate to meet specified business needs Vitek (2010).

These functional requirements include:

- Use of a central vehicle database that is managed by an administrator.
- Licensing of vehicles and updating of licensing database
- System inquiry to check vehicle license status
- Record vehicle and driver details of impounded vehicle
- Track storage history for all impounded vehicles
- Auction vehicle impounded for over three months
- Perform integrity checks and allow users to validate and verify data before it is stored in the system.
- Function to prevent unauthorized updating, deleting and retrieval of stored information.

Use Case Diagram
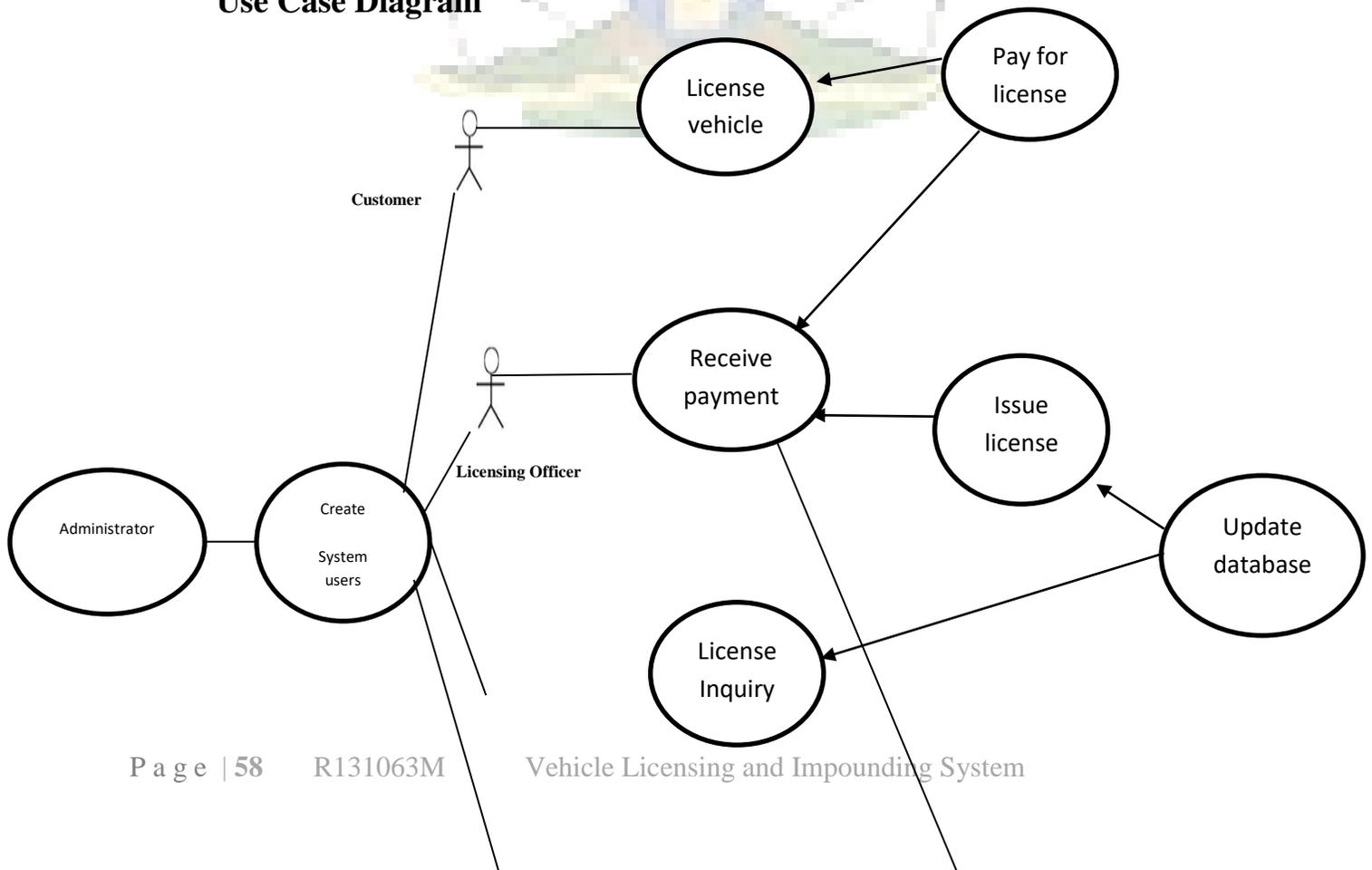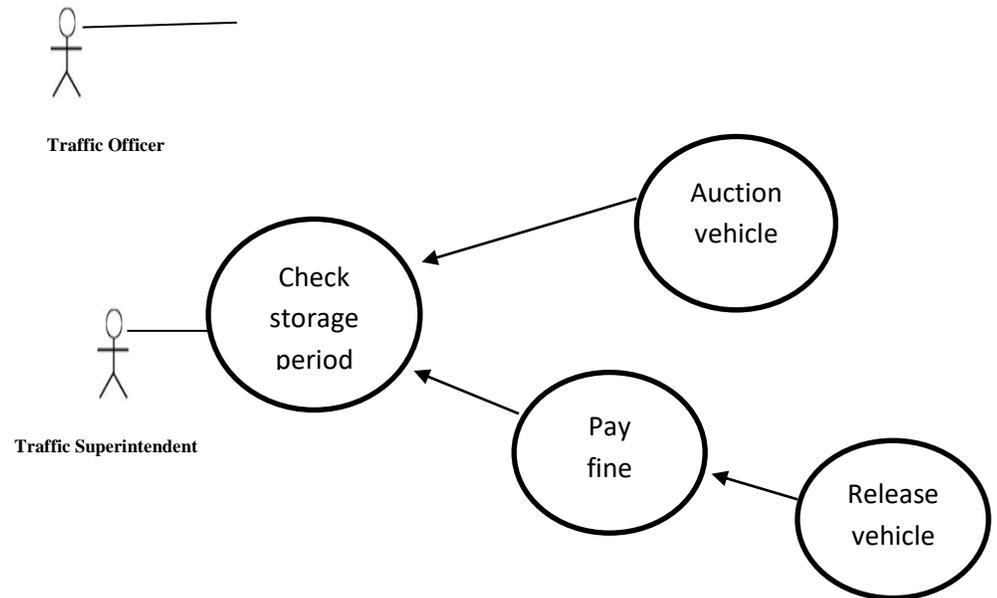
Figure 3.3

3.7.2 Non-functional requirements

Non-functional requirements are not concerned with the functionality of the system Lindvall (2005). Their impact is not confined to a single part of the system, but affects the entire system. The following non-functional requirements were considered:

- Use of strict passwords and various views to control access to data, to reduce unauthorized access to data.
- Users of the system, should have personal computers or access to machines
- The database must have username and password feature, assigning individual users to specified functions, according to their responsibilities.

- The system should be highly interactive and user friendly to allow users to easy access and work with the system.

- Database system must be backed-up according to the organization's information technology and business continuity plan.
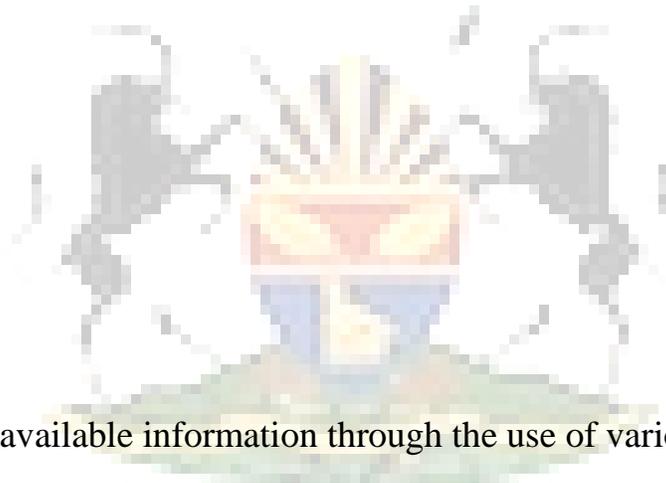
3.7 Conclusion

After considering available information through the use of various techniques, such as questionnaire, observations and document review, it was unanimously decided that a new system should be developed internally, to address current processing needs in the traffic enforcement department. The next chapter discusses the design phase which used various techniques and principles for purposes of defining a process or system in sufficient detail to permit its physical realization

CHAPTER 4: DESIGN PHASE

4.0 Introduction

Design phase involves applying several techniques and principles to define a particular process or system in detail Kendall (2002). This includes designing of both input forms and records, within the system. This chapter looks at systems design, architectural design, which shows the context and dataflow diagrams for the new system. Database design and interface design will also be discussed in this chapter.

4.1 System Design

Systems design involves satisfying specified requirements by defining the system architecture, components, modules, interfaces, and data. The new system is expected to offer enhanced functionality and improvements, by addressing weaknesses from the old system. The new system will capture vehicle and driver details during licensing of all vehicles. It will also issue tickets for all vehicle offenses that will have been committed within the metropolis. Clamped vehicle details will also be stored in the new system as well and warehouse information pertaining to all stored vehicles. Inquiries on outstanding debtors, will be done in the system, before licensing a vehicle or releasing a clamped vehicle from the warehouse.

4.2.1 Context diagram of proposed system

System boundaries are outlined in a context diagram by pointing out sources and destinations. High level logical system designs can be easily visualized by drawing a context diagram, for both users, analysts and management. The system is displayed as a series of processes that accept data and provide information to external entities. A context diagram also has the benefit of visualizing the implications of different boundary assumptions, by providing an overview of how users and the system will interface as well as what information would be passed around.

Context diagram

Impound vehicle

Generate accounts

Accounts

Update details

inquiry

Management

Users

Licensing Rates

Reports

Traffic Superintendent

Users

Figure 4.1

Key

Entity
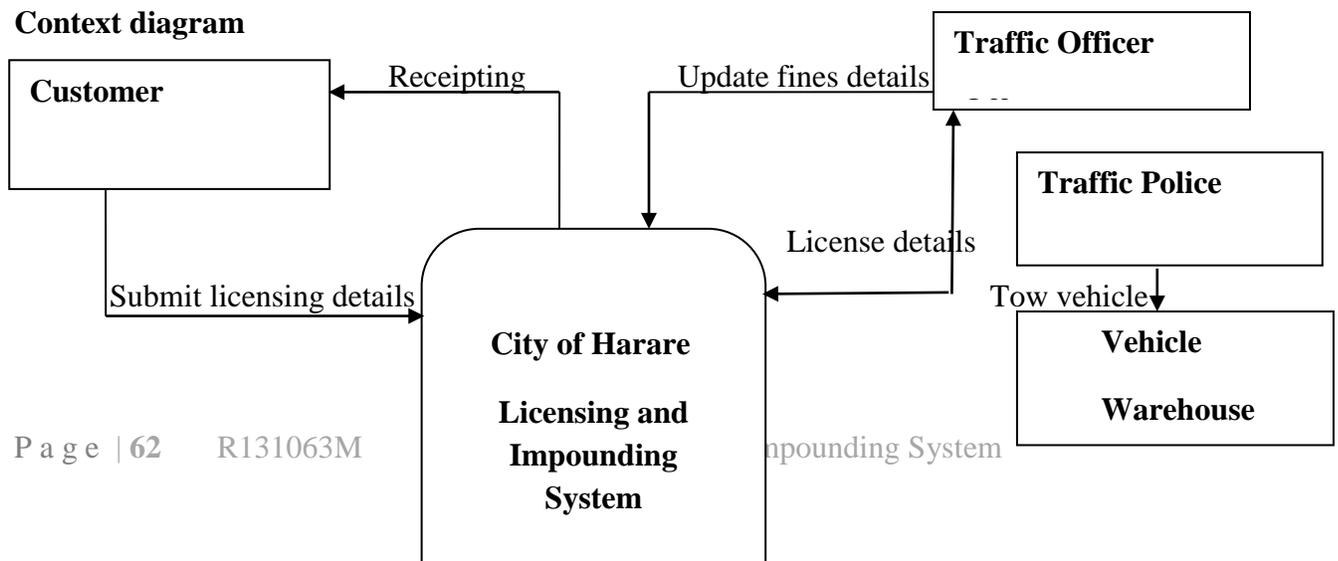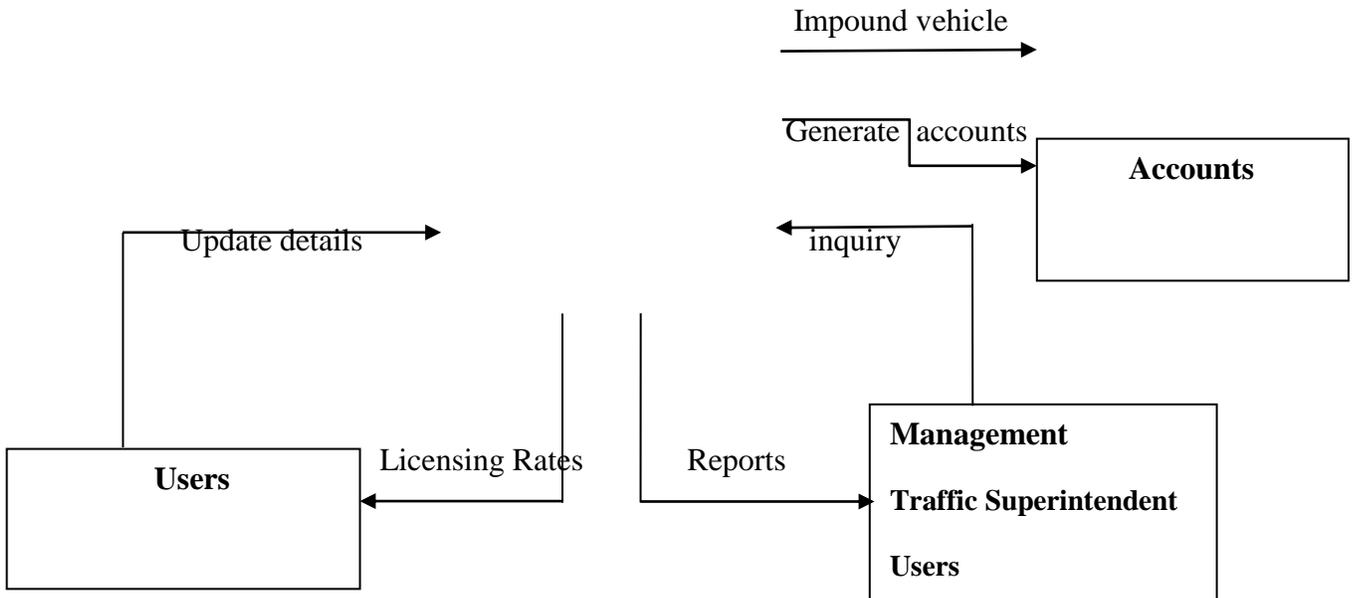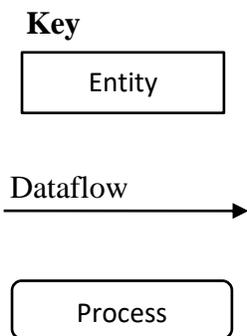
Dataflow

Process

4.2.2 Data Flow Diagram

A data flow diagram illustrates how input and output data is processed in a system. Whitten et al (2003). It focuses on where data originates, its destination and how it is stored. Primary processes within a dataflow diagram are independent, and separated by intermediate data stores, which lead to the physical design of the system.

DATAFLOW DIAGRAM

ADMINISTRATOR

P1
Create System users

D1	User Database

License Application

CUSTOMER

Bill

P2
License vehicle

D2	Licensing Details

P3
Pay for License

D3	Payment Details

Return Payment Receipt

Licensing Officer

Figure 4.2

	Entity	

→ Data flow

Process

Data store
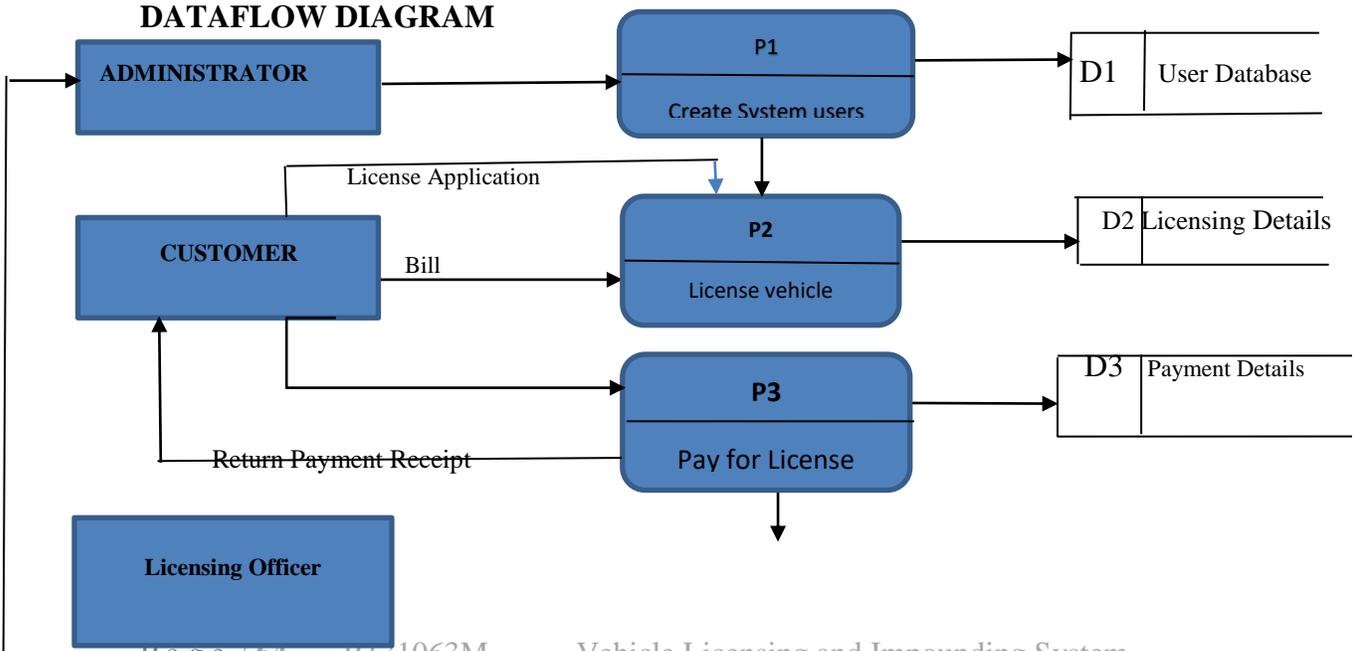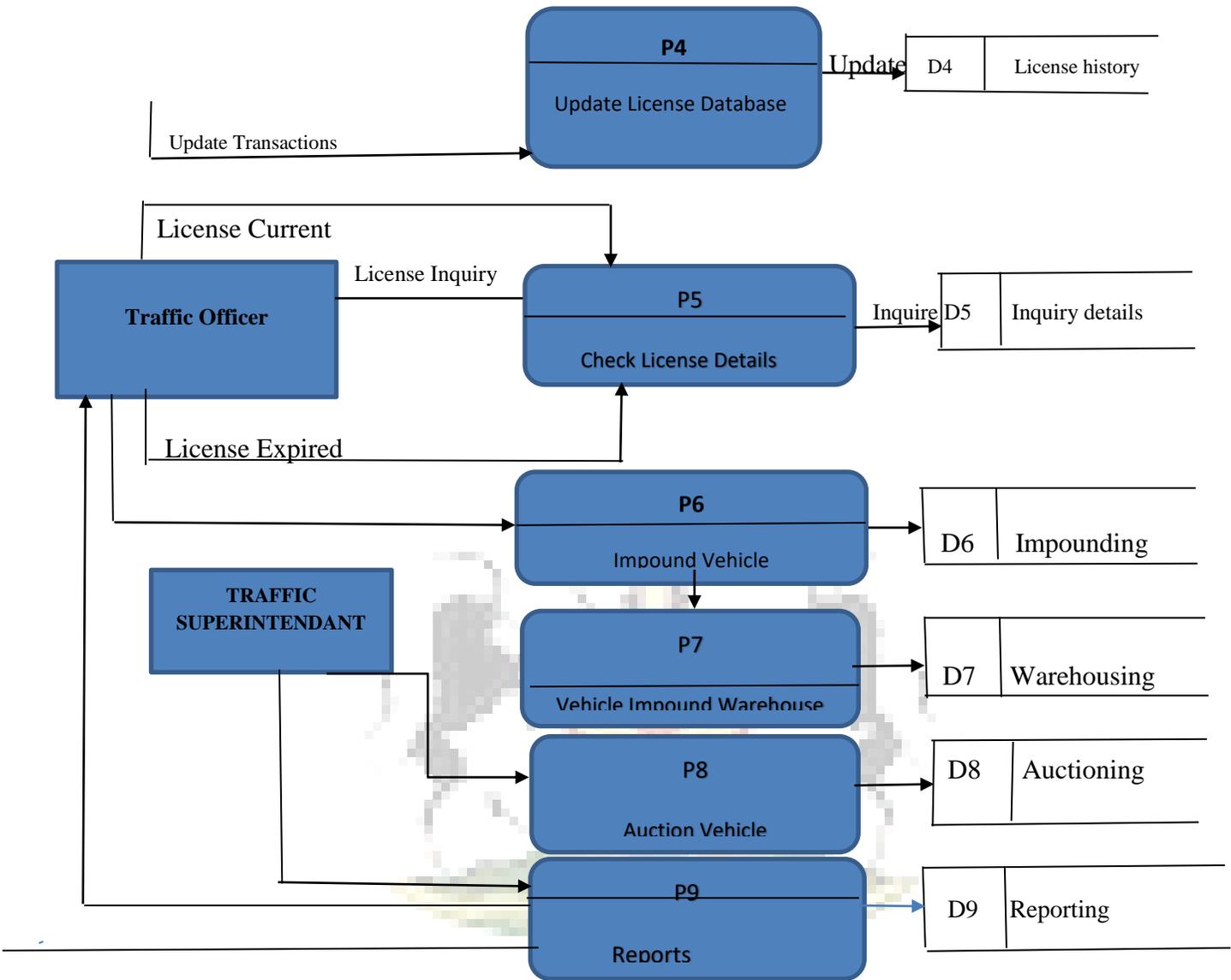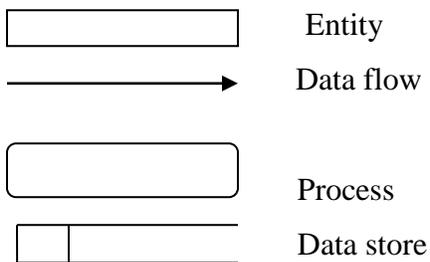
4.3 Architectural Design

System architecture is a collection of methods, standards, and techniques that are agreed to, for purposes of building complex functions, Northwestern University, System Architecture Primer (2004). This facilitates the building of simpler components for easier division of responsibilities, and increases incremental change and functional reliability. It includes hardware and software requirements as well as the architectural setup of the system. A central server will be configured at Harare Municipality's Rowan Martin building, to allow for accessing and updating of transactions including database storage.

The system will be accessed by users from the internet, using any internet browser or handheld device. User machines will access the database and application servers, through fiber network infrastructure that is installed at all Harare municipality offices. This fiber infrastructure allows for VPN connections from all city of Harare offices to the main server and Rowan Martin building head office.
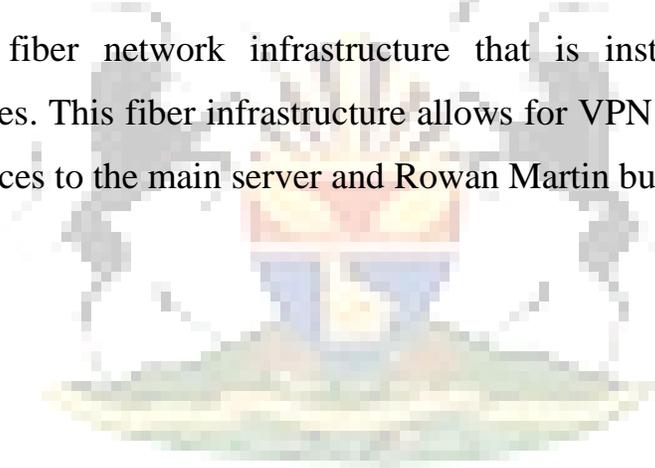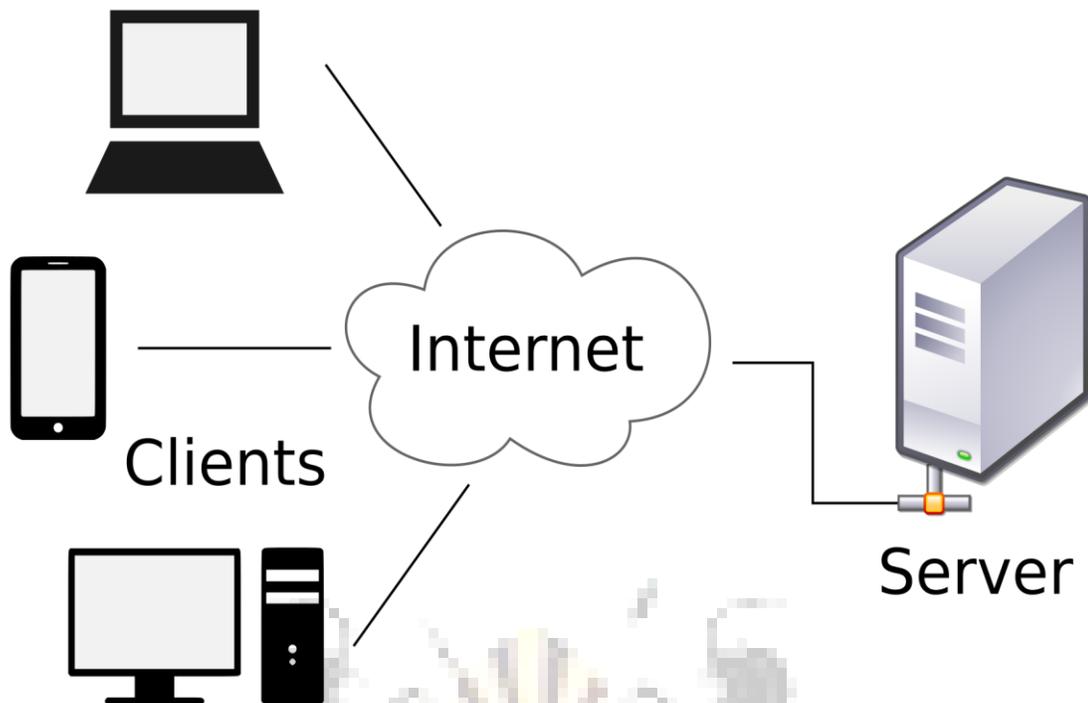
Figure 4.3 Client server Architecture

4.3 Benefits of client server architecture

- Centralized management and control of network resources
- Changes can be easily done by upgrading the server only
- Remote access to servers is made possible
- Sharing of resources
- Backing up of data from a central location is made easy
- Servers are able to do different functions and roles for multiple clients

4.4 Physical Design

It explains the hardware structure and the software component layout for the new system as well as their iteration. Users will access the central database and other network resources, through a wide area network (WAN).

Hardware requirements

- 48 port network switch

- CISCO ASA 5505 Firewall

- CISCO Core switch RJ45

- Cable connectors, network cables, face plates and wireless access points.

- Hewlett Packard Desktop computers

- IBM Blade server

- Fiber media convectors

- Printronix line printer

Software Requirements

- Microsoft Windows 2012 Server

- Microsoft Windows 8 operating system

- Visual Studio 2012, PHP and Dreamweaver

- Microsoft SQL Server 2012 database
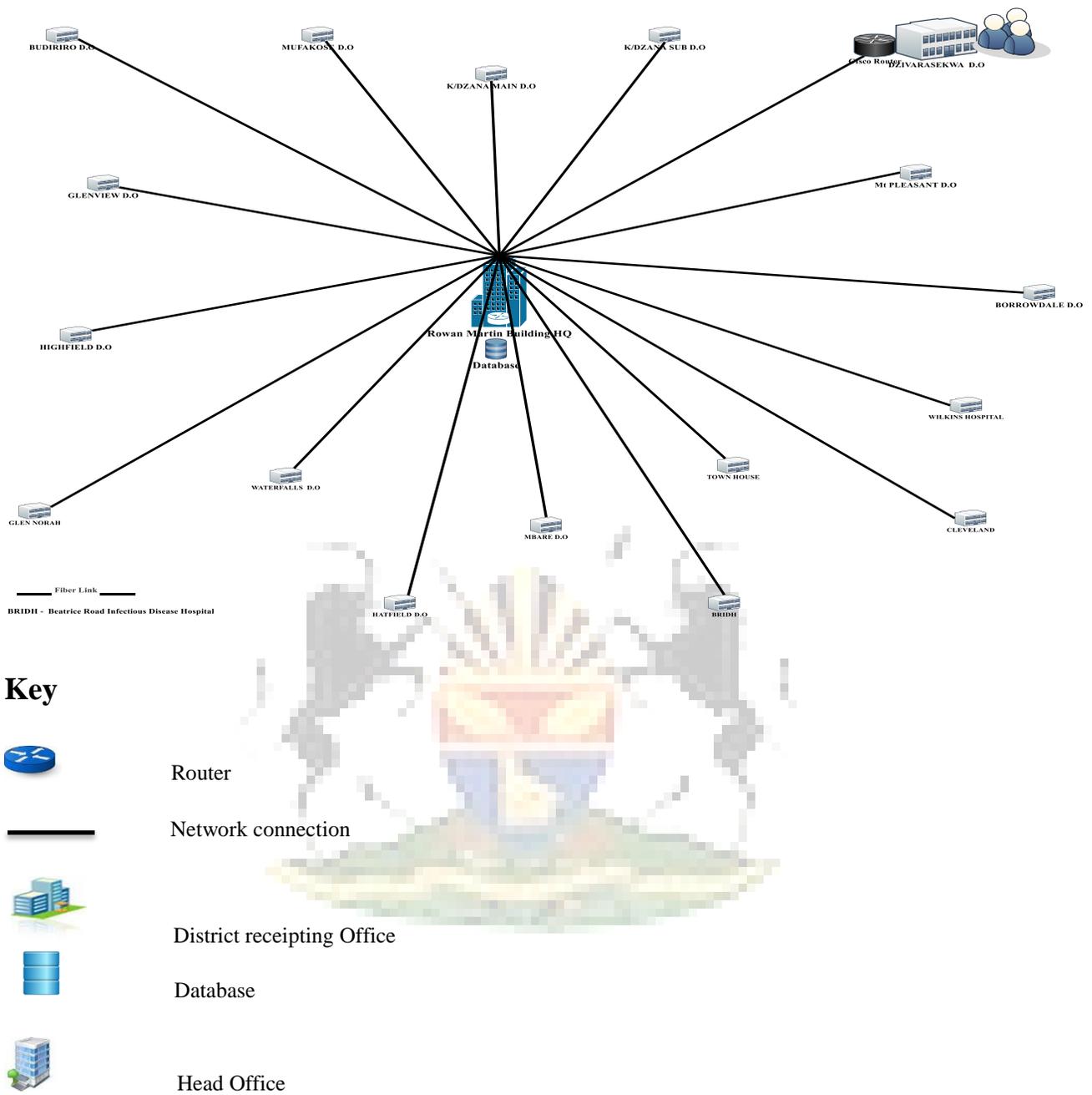
Figure 4.4: Physical design of proposed system

Key

Router

Network connection

District receipting Office

Database

Head Office

4.5 Entity Relationship Diagram
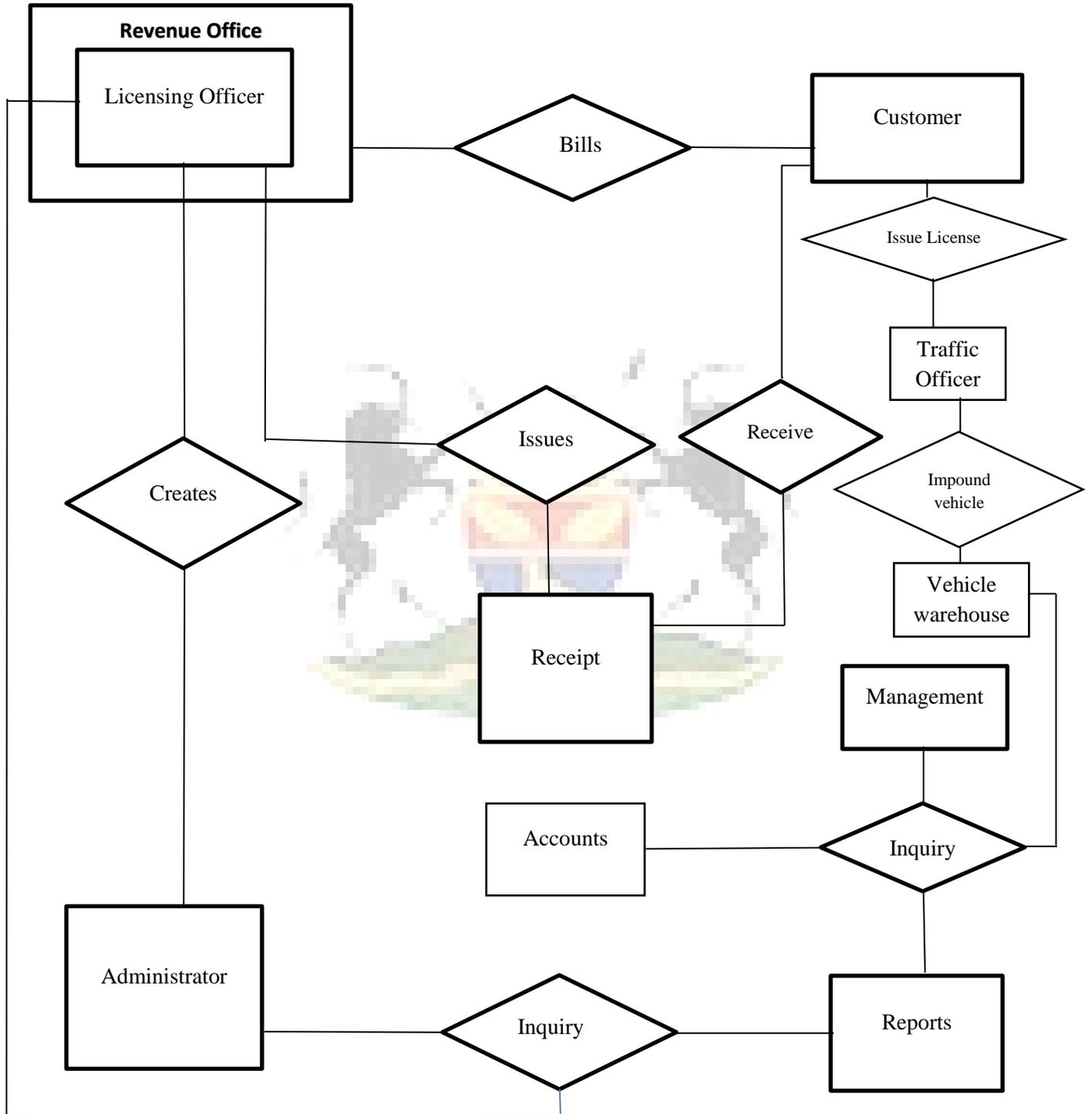
Figure 4.5

4.6 Database Design

Involves the production of a data model, which contains design options as well as physical storage parameters Powell, G. (2005). The system uses a Microsoft SQL Server 2012 R2 database that will be running on a centralized sever. This allows for easy system deployment over a wide area network. Microsoft SQL Server 2012 R2 is the latest robust, interoperable and scalable relational database management system (RDBMS). It is an independent database, which is able to run from multiple operating platforms, such as Windows, Linux or UNIX servers and is less vulnerable to virus attacks when adequately secured and protected by up to date antivirus software. Selected tools and methods were used by the developer to structure and develop the system, with the main aim of coming up with the best database structure for the system.

Database Design Considerations

Database Property	Issue of concern
Storage media	▪ Database size? ▪ Required database connection speed? ▪ Database lay out?
Database change over time	▪ Addition of new attributes? ▪ Increase in stored attributes?
Security	▪ Access permissions and task segregation?
Database Architecture	▪ Centralized or distributed database? ▪ Will the database be partitioned?

Table 4.1

Database design categories

Conceptual level - data stored within a database including existing relationships, with specified attributes. Database queries are also defined at this level including their linkages. This enables users to easily manipulate the database, using queries and structured query language (SQL).

Logical level transforms the independent database schema into a chosen database management system.

Physical level focuses on database performance, by choosing storage structures and access paths for database files. Database performance is measured by the response time, transaction throughput and utilization of disk space.

View level provides a simplified interface which the user can utilize to interact with the database.
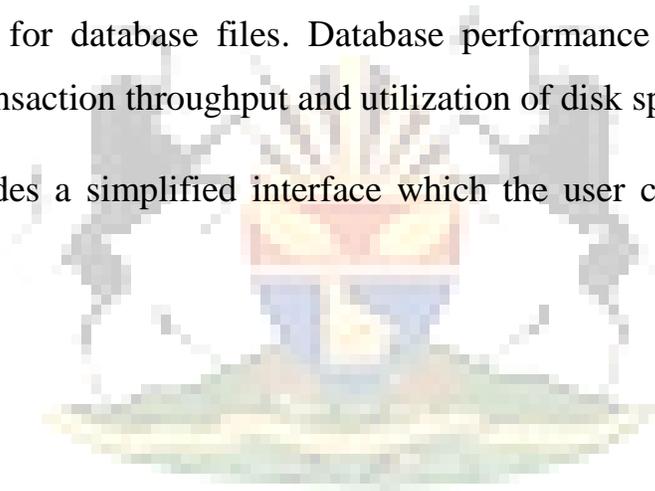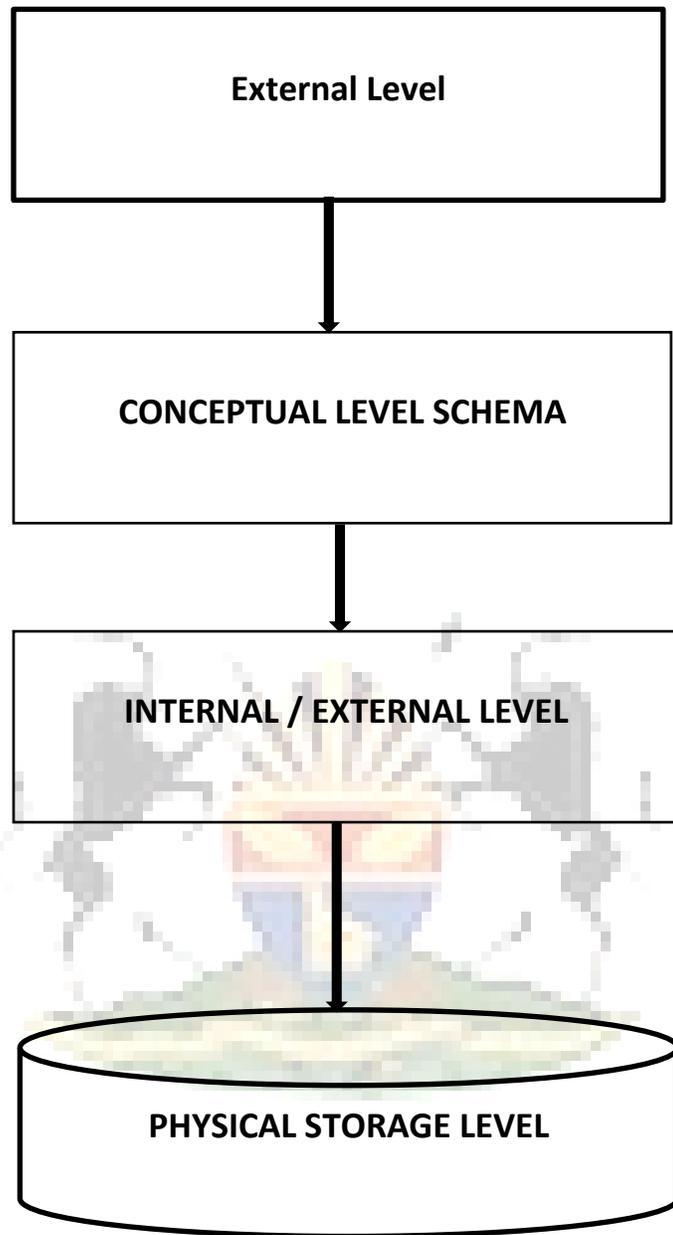
Figure 4.6   Database Architecture for proposed system

Summary of data tables

Field	Field	Description
<u>ID</u>	Integer	user identifier
Username	Text	login name
Password	Text, integer	Unique login secret key

Table 4.2   Login Table

Client form

Field Name	Type	Description
<u>Reg. No.</u>	Integer	Vehicle registration number
Chassis	integer	Vehicle chassis number
Date	integer	Date of registration
Name	Text	Name of the Driver / Vehicle Owner
Surname	Text	Driver details
Username	Text	login name
Amount	Numeric	payment
Password	Varchar	User login secret key

Table 4.3 Client Form

4.6.1 Program Design

Program design involved designing and documenting methods and procedures in software. Logical information is converted into computer instructions to perform required tasks.
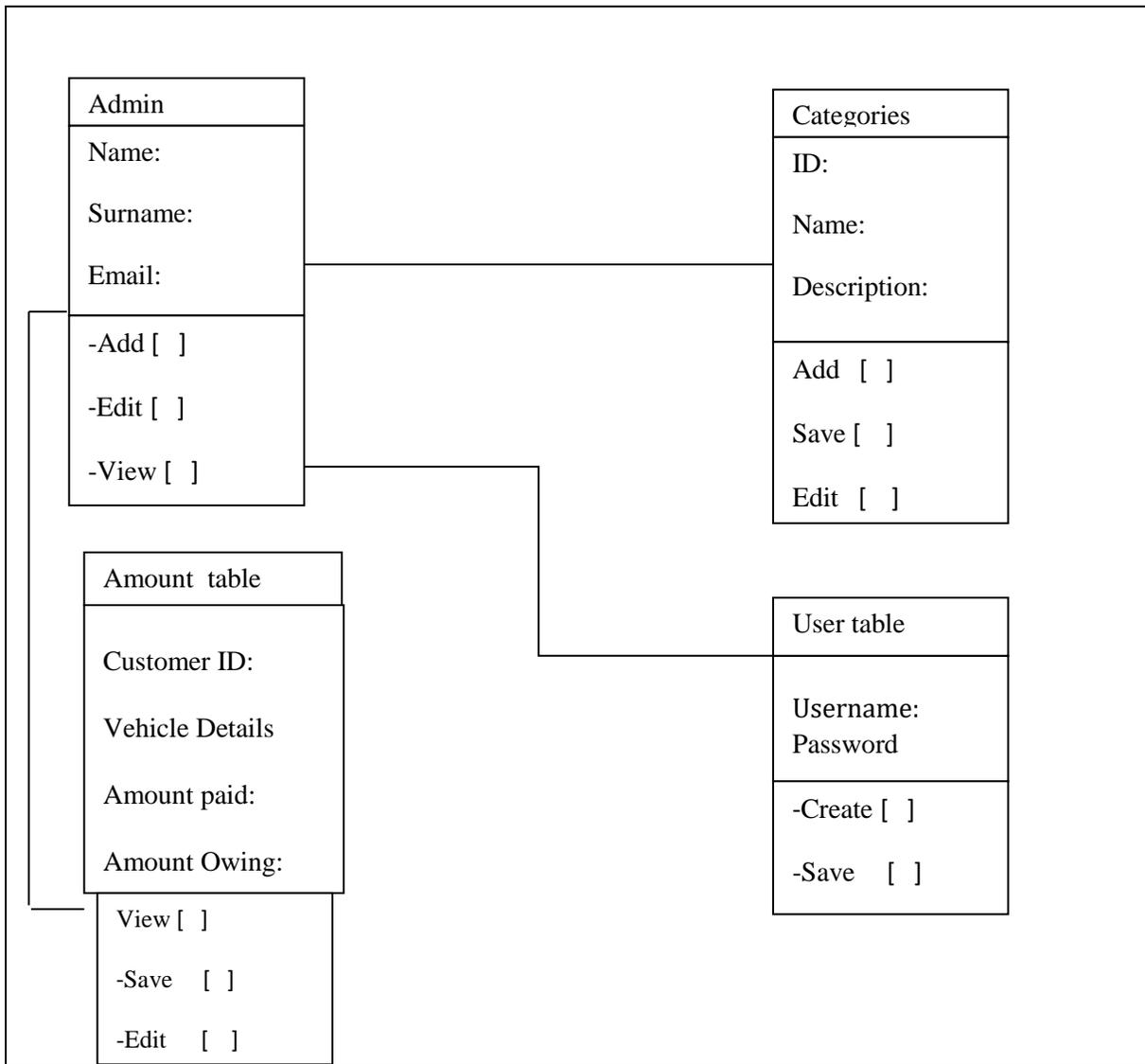
Figure 4.6.1

4.7 Interface Design

Interface design is used for modular system development for purposes of connecting and communication Lauesen (2007). After designing the physical system, the various system components were then designed. The components are used by users to directly interact directly with the system.

```
┌─────────────────────────────────────────────────────────────────┐
│   ┌──────────────────────┐          ┌──────────────────────┐     │
│   │ Evaluation interface │─────────▶│ Develop user scenario│     │
│   └──────────────────────┘          └──────────────────────┘     │
│              ▲                                   │               │
│              │                                   ▼               │
│              │                       ┌──────────────────────┐     │
│              │                       │Develop interface     │     │
│              │                       │structure             │     │
│              │                       └──────────────────────┘     │
│              │                                   │               │
│              │                                   ▼               │
│   ┌──────────────────────┐          ┌──────────────────────┐     │
│   │Design interface      │◀─────────│Design interface      │     │
│   │protocol              │          │standard              │     │
│   └──────────────────────┘          └──────────────────────┘     │
└─────────────────────────────────────────────────────────────────┘
```
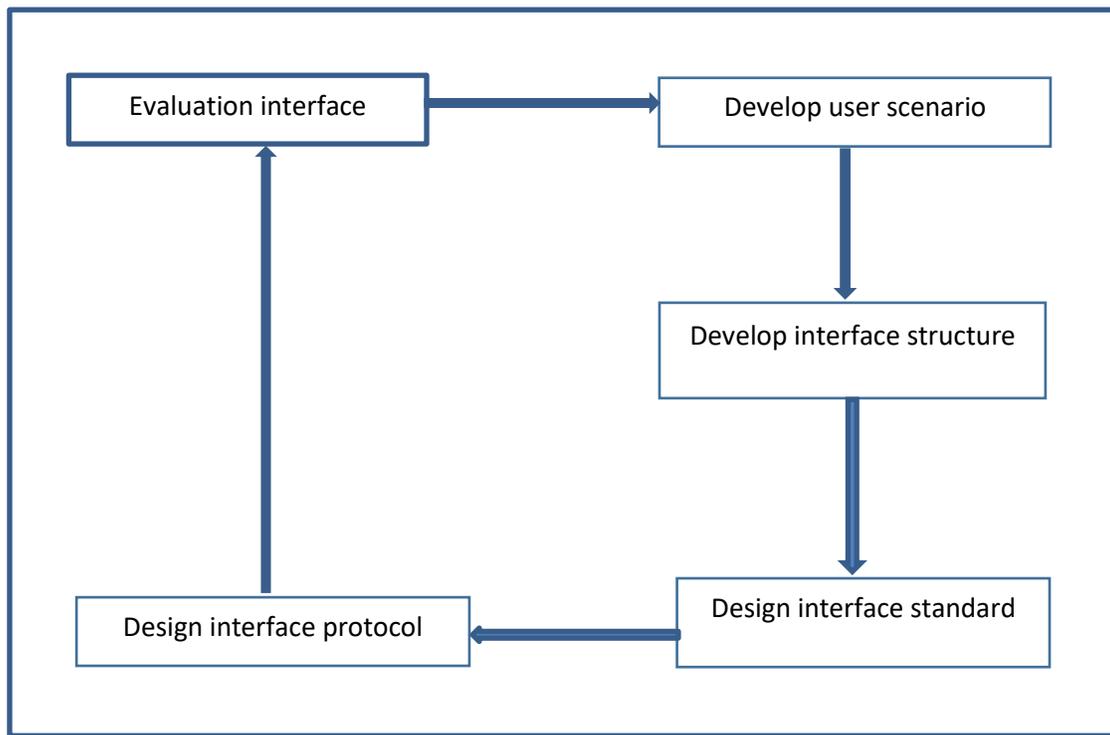
Figure 4.5   Interface Design

Three different views with different access levels are available:

1. **Traffic Officer**
   Role of the Traffic Officer
   - Check for vehicle registration (info will be provided from the database for all the registered vehicles).
   - Checks for permits and authorized routes (this is for commuting vehicles).
   - Issue tickets
   - Clamp unauthorized parked vehicles.

2. **Licensing Office**
   Roles of the Traffic Office
   - Vehicle registration.
   - Create traffic offences and their charges.
   - Issue permits (commuting vehicles).
   - Accept ticket payments/fines.
   - Follow up on outstanding payments.
   - Release confiscated vehicles.

3. **Administrator**
   Roles of the Administrator
   - Add user and their authorized access levels.
   - Delete users.
   - Modify password, access levels and usernames.

4. **Traffic Superintendent**
   Roles of the Traffic Superintendent
   - Auction vehicles
   - Report Inquiries

REPORTS

The system will generate ad-hoc reports for the major processes as per request of the management team.

The proposed system will use different input methods for data input. Menu options are available for users to choose from, depending on the task to be performed.

System layout

Various types of input forms, which are user friendly will be available for users to choose from. These will be in graphic user interface (GUI) form.

Main Menu Form

Access to all modules will be done from the main menu. The proposed application will contain an input form for entering the necessary data, such as vehicle details, license information and other relevant details.

Output Design

Output design refers to on-screen reports and paper-based report formats, which also determines how information is to be displayed, either as hard copy output or screen display Wooldridge (1975

4.8 Conclusion

This chapter outlined system, architectural, database and outline design. Completion of the design stage allowed for commencement of the implementation phase, which involves coding, testing, installation and maintenance of the new system.

CHAPTER 5:   IMPLEMENTATION PHASE

5.0 Introduction

The chapter outlines implementation of the design solution and the technologies used were chosen based on availability, applicability and ease of use. In this section, the system will be tested before it goes into live operation, so as to guarantee users requirements satisfaction. After successful testing, the system will be installed and officially launched for utilization.

5.1 Coding (Pseudo code)

Coding is implementing the specified design into executable programs. Choudhury (2014). Visual Studio C#, hypertext markup language and Dreamweaver, were used in program coding.

Log on

Enter username and password

Select user login type

      If invalid then

      Repeat process until valid

If logged in as Administrator

      Create Users

      Delete Users

      View Users

Change Password

Reports

Logout

Elseif logged as Traffic Officer

Issue Tickets

View Tickets

Vehicle License Check

Logout

Elseif Logged as Traffic Office

New Vehicle Licensing

View Registered Vehicles

Issue License

Enter Offenses and Charges

View Offenses

Reports

Logout

Else

Undefined Access

End if

5.2 Software Test

Software testing is analysing software detect variations in existing and required conditions. Myers (2004). Software that is developed is successful once it meets all user requirements. Excluding important software development processes renders the exercise incomplete. Software testing was therefore, performed to verify expected software functionality. The aim was not, to find all bugs in the new system, but to highlight situations that could negatively impact the customer.

Unit Test

Module Test

Normal flow of testing

System Test

Sub system Test

Acceptance Test
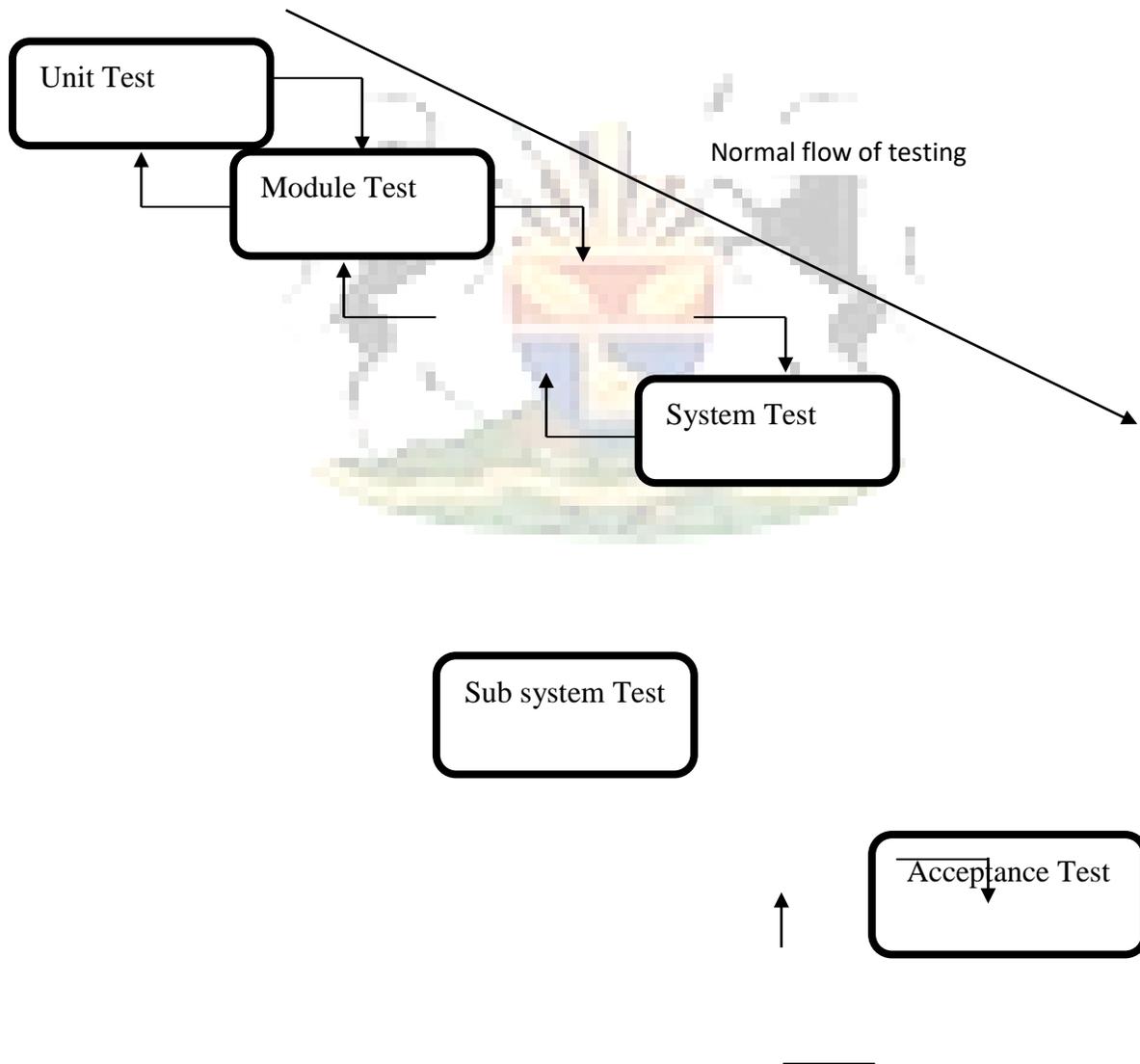
Figure 5.1 Software test life cycle

5.2.1 Unit Test

It involves testing of individual computer program modules and their associated data usage.McFarlin (2012). Individual system components were independently tested, without other system components, to determine functionality. Separate forms were tested and information was also added into the system using forms. The Microsoft SQL Server was then checked to ensure that the information that was input had been updated in the database. Unit testing was successful as data that was captured was updated in the database.

```
Acceptance test
        │
        ▼
    System test
            │
            ▼
        Integration test
                    │
                    ▼
                Unit test
```
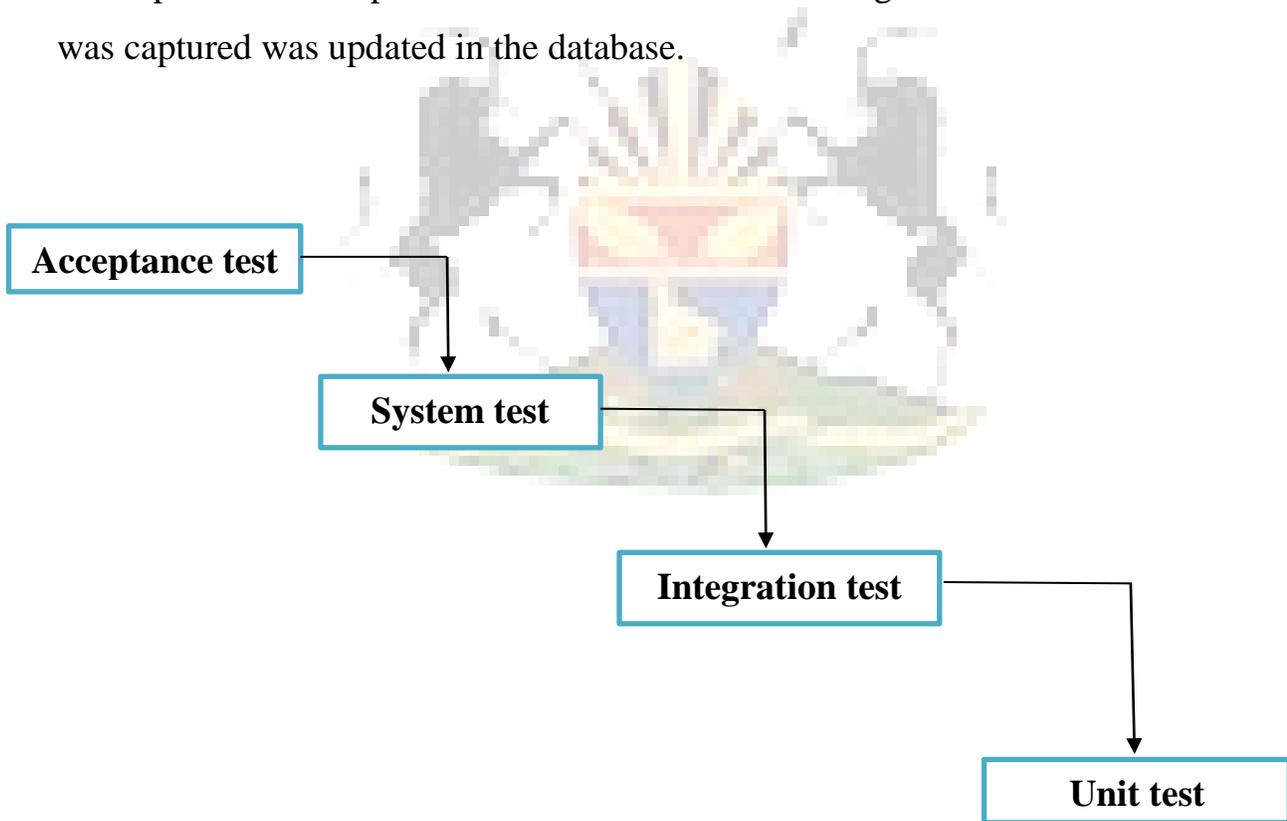
Figure 5.2   Unit Test

5.2.1.1 White Box Test

It is the evaluation of known internal structure of an item. Mishra (2012). White box testing was done to test user interfaces and finer details of a system.

White Box Test Advantages

- Testing is started early, without waiting for availability of Graphic User Interface (GUI), to be ready.
- It is thorough
- It is broad and covers many paths

Disadvantages of white box test

- It is very complicated
- Highly skilled programmers are need to implement procedure
- Unavailability of implementation tools

5.2.2 Integration test

It is the integration and testing of combined individual units Mishra (2012). Customer accounts, vehicle registration, fines data, registration forms and outstanding balance function, were tested for integration, to ensure they are properly interacting with each other, thus meeting the requirements.

5.2.2.1 Black Box test

Black box testing involves the testing of items whose internal structure in not known, white box testing involves testing an internal structure that is known. Testing was totally based on functional requirements of work, product and software application.

Black box test diagram
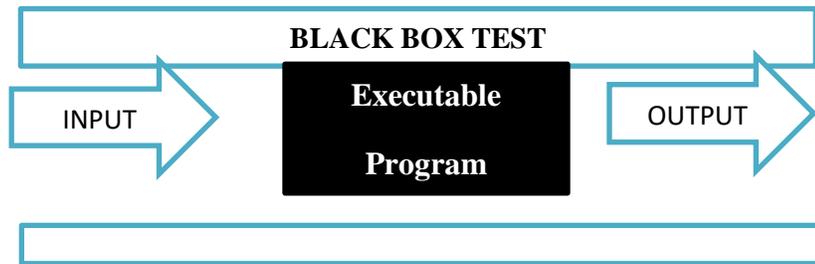
Figure 5.3 Black Box Test

5.2.2.2 Defect test

Defect testing was also done on the vehicle licensing and impounding system, to identify faults in the system. Data overflow and type mismatch simulations were carried out, to check for defects, before delivery of software to users.
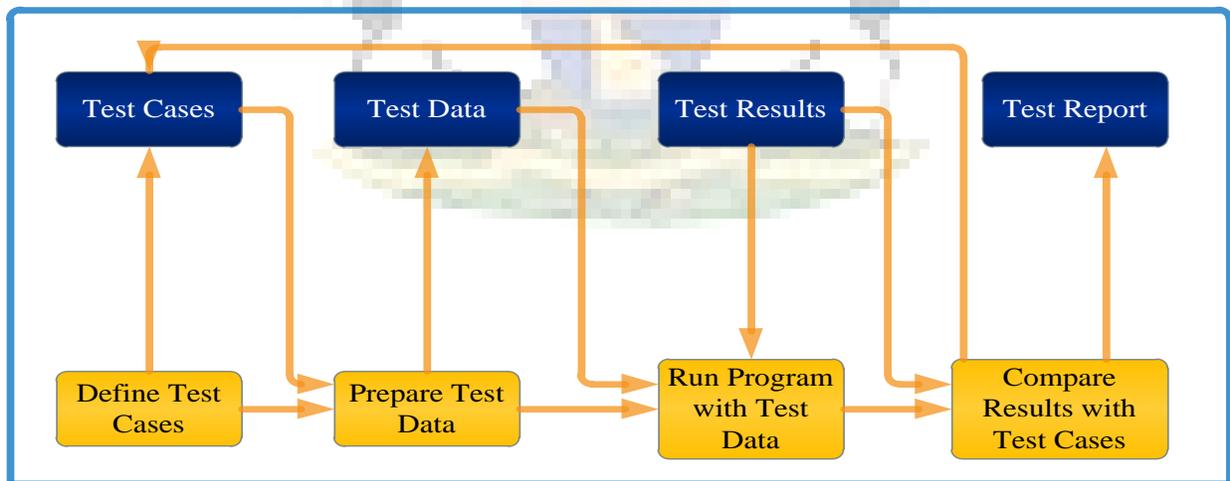
Fig 5.4 Defect test diagram

5.2.3 System Test

During system testing, the writer was concerned with finding errors, which could have resulted from the interactions of the various system components. Forms were also checked to ensure that they are communicating well with each other and the database. All information being entered into the system is correctly updating in the database and this confirms that the system has been properly designed.

5.2.3.1 Subsystem Test

Subsystem testing is the process of checking, the functionality of standalone components of the system. During this stage the writer tested the interfaces to detect interface mismatches and vigorous exercising of the relevant interfaces. Forms were taken as separate subsystems and then tested, to determine if they are functioning well.

5.2.3.2 Alpha Test

Specific processes, input and actions carried out by system users, were noted, in an attempt to come up with a suitable system. During alpha testing, abnormal system behavior was identified and rectified.

5.2.4 Acceptance Test

The system was tested for acceptability and to assess if it was ready for delivery. The two categories of acceptance testing that were carried out are user (UAT) and business acceptance testing (BAT).

5.2.5 Validation

Validation determines is software satisfies specified requirements. Software was evaluated during and after the development process, to ensure that it satisfied, specified business requirements and user's needs, with correct specifications.
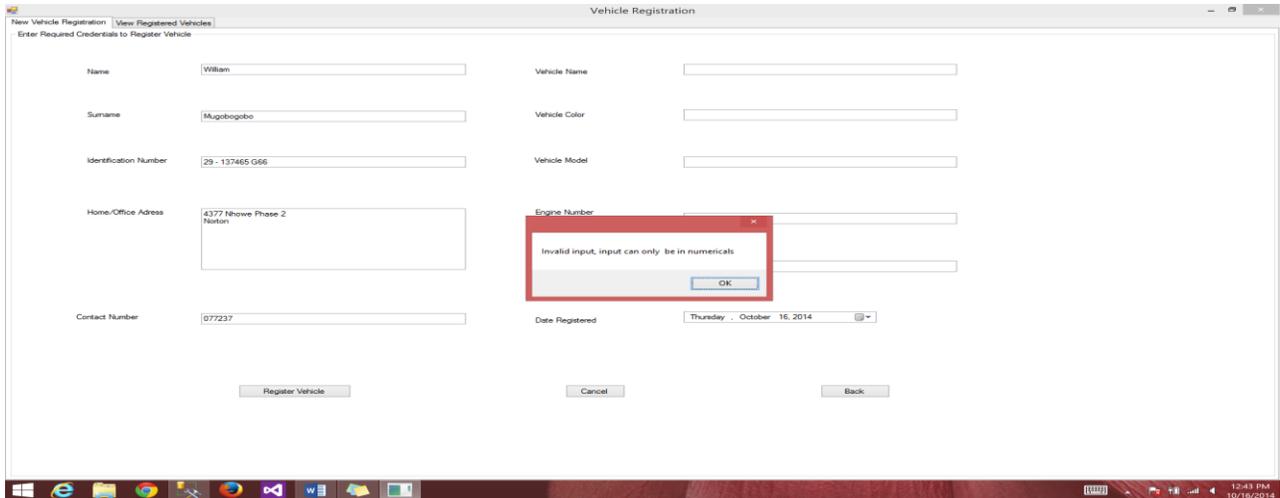
Figure 5.5   Validation
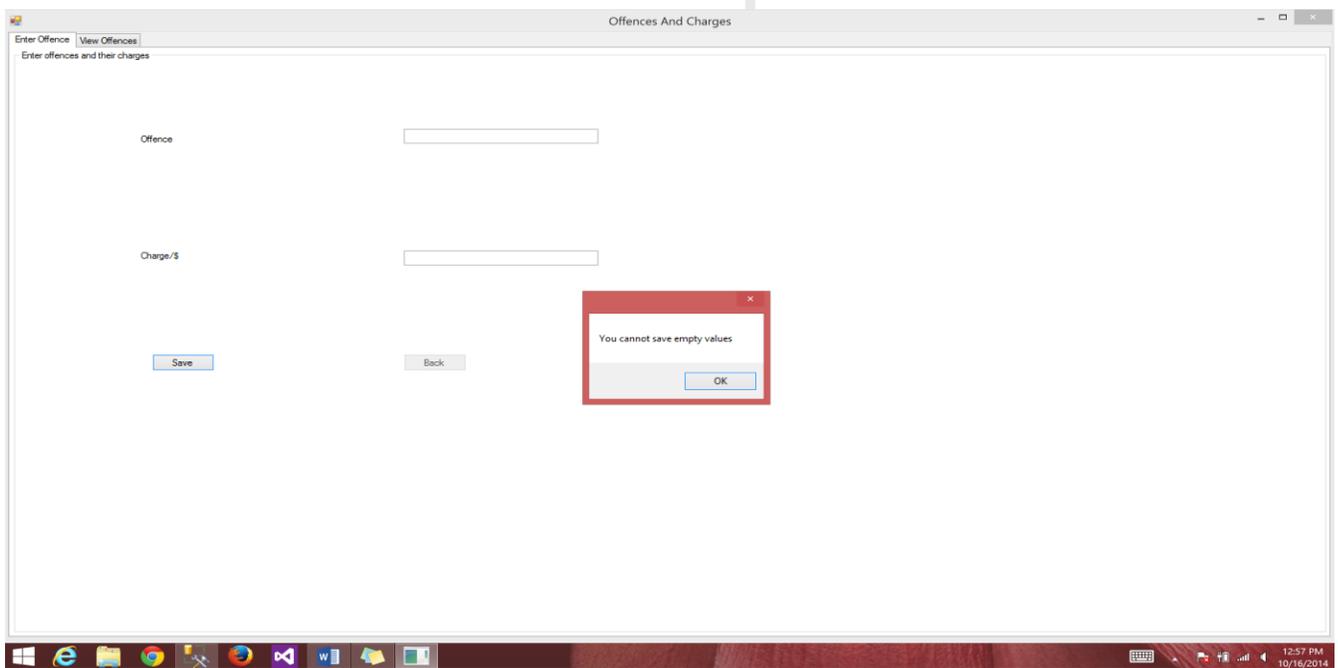
Figure 5.5.1   Input validation

5.2.6 Verification

Verification is done to ensure that the product is built right and meets its specified requirements. It is also known as quality assurance because it acts as a preventive

measure when determining standards Mohit (2011). A snap-shop of an input verification process is given below.
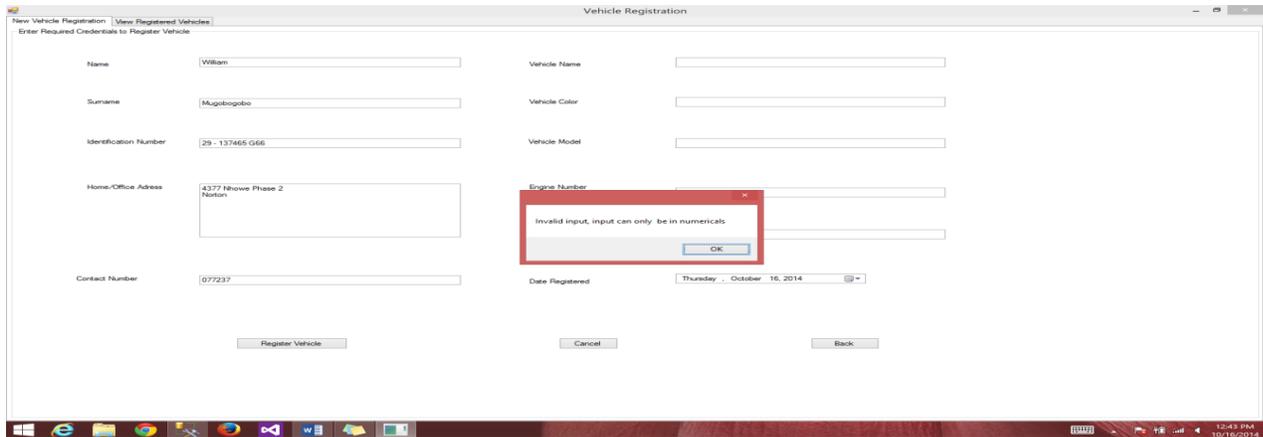
Figure 5.6   Verification

Verification and Validation
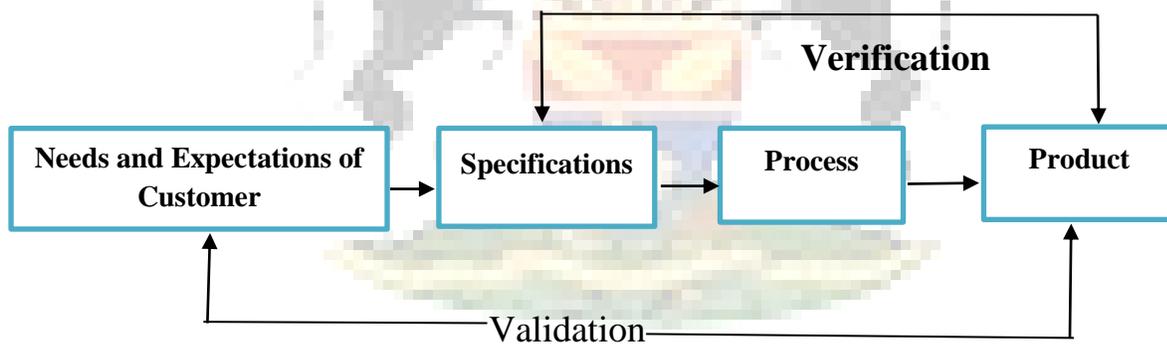
Figure 5.7

5.3 Installation

The system was installed using the following steps;

- Install from external flash disk
- Double click installation file licensing.exe.
- Add system data source, licensing.
- Connect data source to database

- Share database giving appropriate access permission, according to function

- Create startup icon on desktop, by creating a shortcut of the executable file, on each users' desktop, from the bin folder.

- Users running Windows 8.1 64 bit application must first install the Wow 64 bit to 32 bit conversion application, to be able to run the system which is a 32 bit application.

- Right click on Wow(64bit) 32bit icon and chose run application as Administrator, to open vehicle ticketing management system login screen

5.3.2 User Training

System training involves training the system users, such as the administrator on how to administer and use the system. This includes installation of the software, software updates, creating and managing users, security administration as well as backup and restore procedures. User training was also scheduled to train users who will use the system, in the various respective modules. The training plan includes creating, amending and updating relevant records, user backups, login procedures and required security procedures to keep the system's integrity and security. To assist in the training of users a user manual containing system information and user procedures will be documented. After successfully testing the system and training the users, the system is deployed to the users, for their use.

5.4 Maintenance

It is the last phase in software development that involves modifying software components after delivery, to correct faults, and improve performance. It is also

done to enhance system or adapt to changes in the environment. The maintenance phase, allowed individuals to check software performance, after it was launched to see if it was working correctly.

5.4.1 Maintenance importance

- Ensures that system remains running at high performance levels
- Solves software bugs
- Increases system functionality
- Software customized to users' specific needs.

5.4.2 Corrective maintenance

- Modification to correct problems that will have been discovered
- Correction of identified errors.
- All modifications and enhancements to the system will be properly documented

5.4.3 Adaptive maintenance

The software will, were necessary be modified to adapt to changing economic, social and technological changes and advancements. New technologies, add-on modules and operating platforms are developed all the time and the system will be maintained and modified to adapt to these changes, in order to remain relevant and efficient.

5.4.4 Perfective maintenance

Maintenance was done to improve system performance after delivery.

5.4.5 Preventive maintenance

Preventive maintenance (PM) was done to reduce unplanned breakdown of the system. This included, systematic inspection, detection, correction and prevention of any failures. Preventative maintenance was, therefore be carried out on a regular basis according to Harare City Council Information Technology Policy.

5.4.6 Constraints

Like any the software development project, there were challenges that were encountered, during the development of the Harare City Council Vehicle Licensing and impounding system. A summary of which are time constraints, due to the limited time to deliver the system into production, insufficient financial resources due to competing organizational priorities, organizational politics due to varying interests and in-depth skills and access to newer technologies that are on the market.
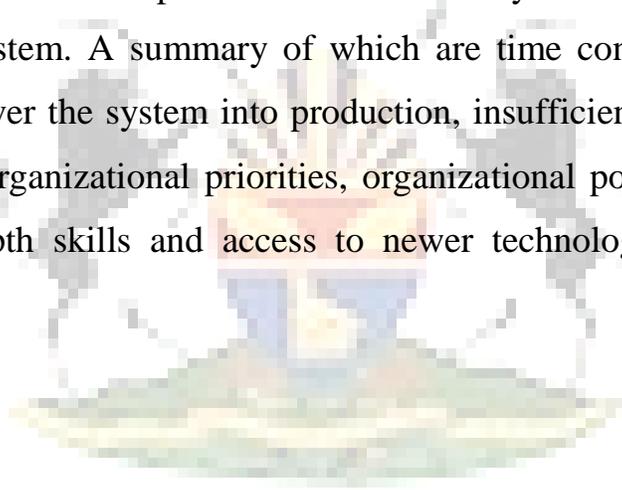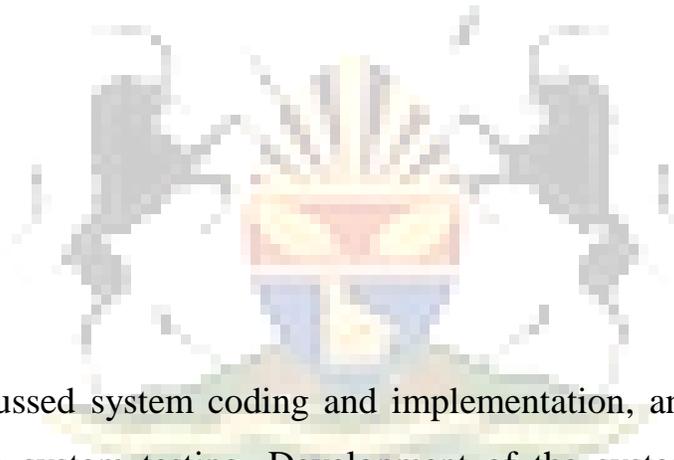
5.5 Conclusion

This chapter discussed system coding and implementation, and testing strategies that were used in system testing. Development of the system was centered on objectives and user requirements specified in the project proposal. Budgetary constraints were encountered along the way but innovation, resilience and management support ensured continuation of the project. The system was successfully implemented according to user and business requirements.

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Appendix A: **User Manual**

CITY OF HARARE VEHICLE LICENSING AND IMPOUNDING SYSTEM
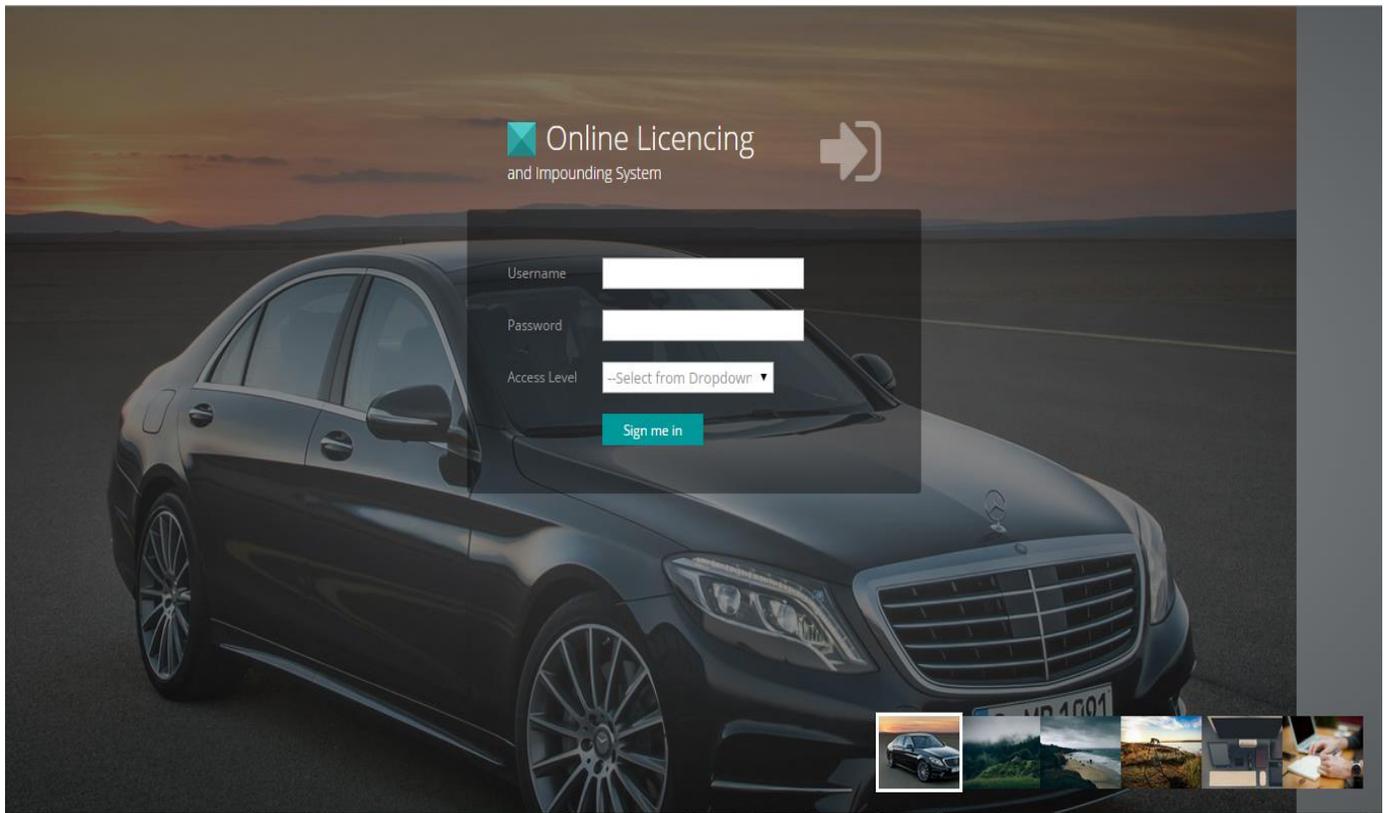
USER MANUAL

City of Harare Vehicle Licensing and Impounding welcome screen.

The welcome screen above is loaded when you double click the icon on desktop, to access the system from the desktop.
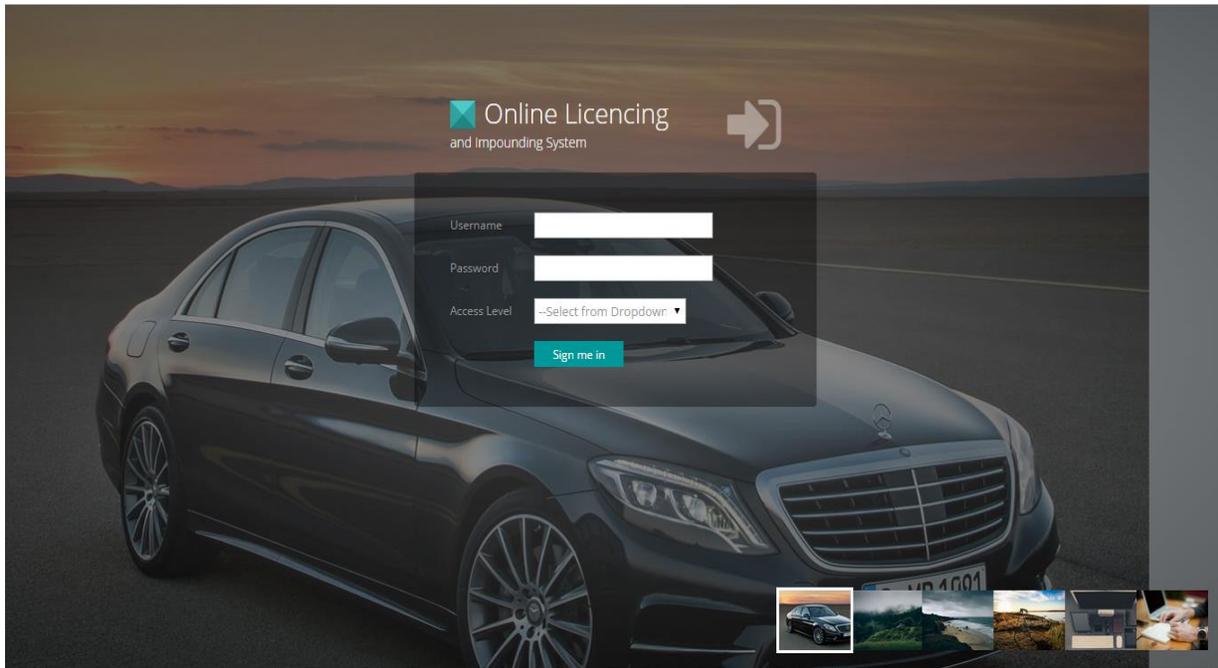
To login to the system enter a valid username and password combination that is given by the Administrator.

Enter access level which is either administrator, Licensing Office or Traffic Officer, according to your function, as assigned by the administrator and click the login button to login to the system.

To access administrator options enter username, password and use the drop down access level menu to choose the administrator access level to login.

Administrator option has super user privileges to add, amend and delete users

After choosing the view option you are presented with menu options for the following:

1. Vehicle Registration
2. Licensing
3. Fines and Tickets
4. Offenses and Charges
5. Reports
6. About Us

Choose the appropriate menu and follow on-screen instructions to continue.

Vehicle registration

Chose the vehicle registration screen to input vehicle driver and owner details and click the register button after inputting all the information. The registration details will then be updated in the Microsoft SQ Server database.

You can also view registered vehicles through the search facility on the same screen.

New user registration

Option for entering new user allows Administrator to create and register new users in the system. The user's first name, surname, work number, contact details, password and access levels can be defined on this screen.

If you make an input error you can choose the clear button and make changes to your record and then click submit after the amendment has been made.

Parking license issuance

The parking license screen allows user to enter vehicle registration details and search for the license and licensee details. If a vehicle is not licensed the user can then enter the details to register vehicle.

After entering all the required details, you then click the register button or cancel to reenter details.

Change password screen
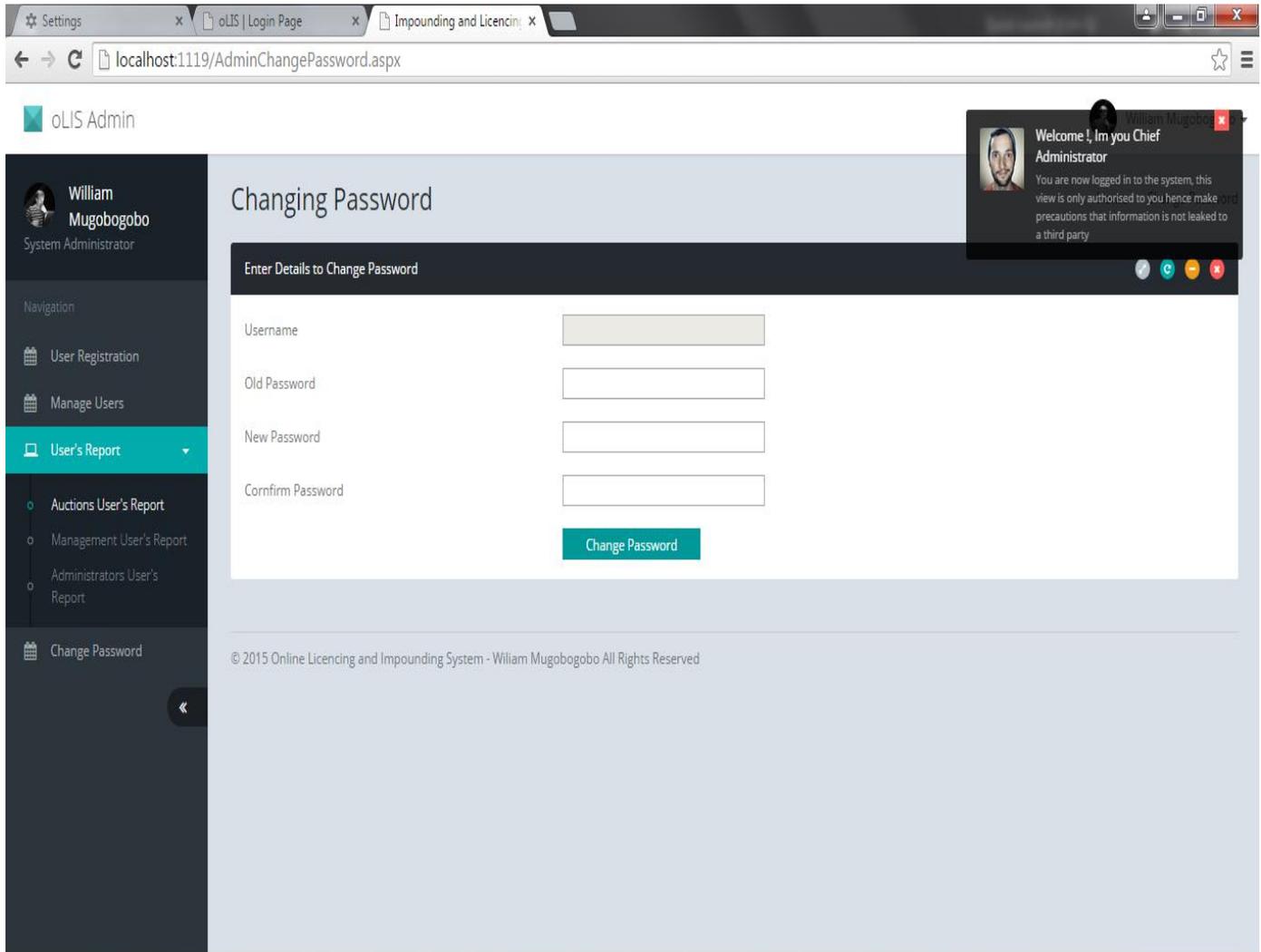
The Administrator function has super user privileges to change user passwords and no other user has the privilege of changing other users' passwords.

To change a password, you need to enter the old password first and then type in a new password, which must also be confirmed. You then click change password to confirm change.

Sample Reports from the system

Auction report
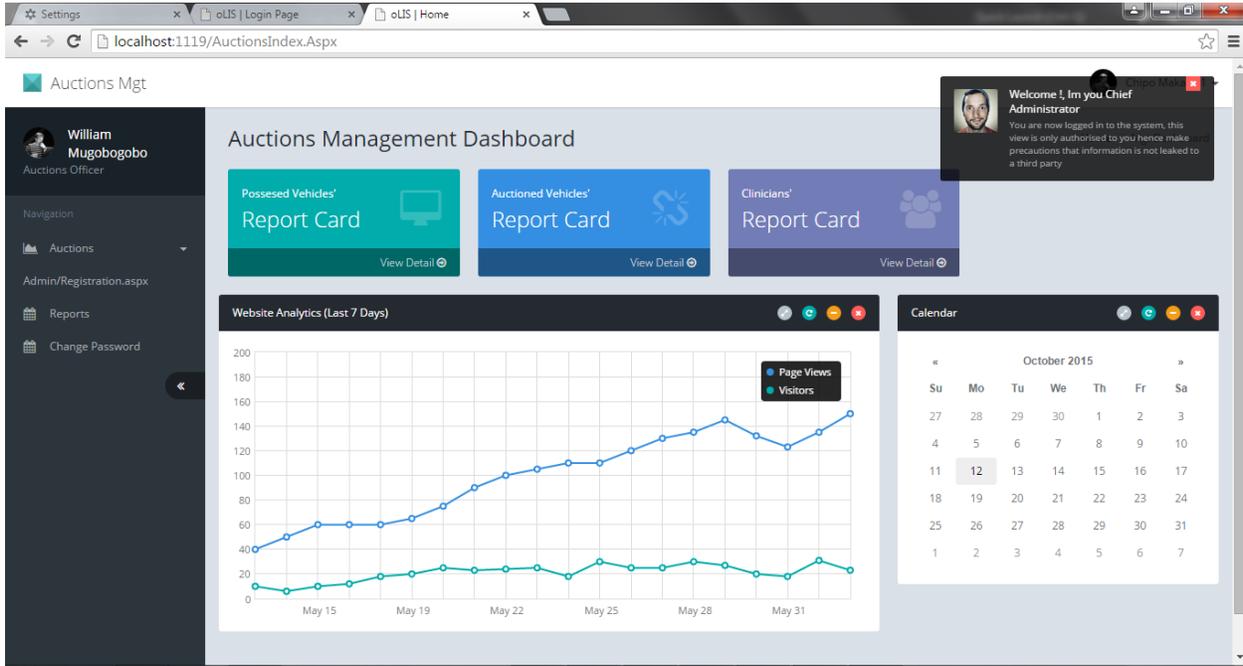
The auction management report show statistical data of vehicles that are due for auctioning after overstaying in the warehouse.

Report Card
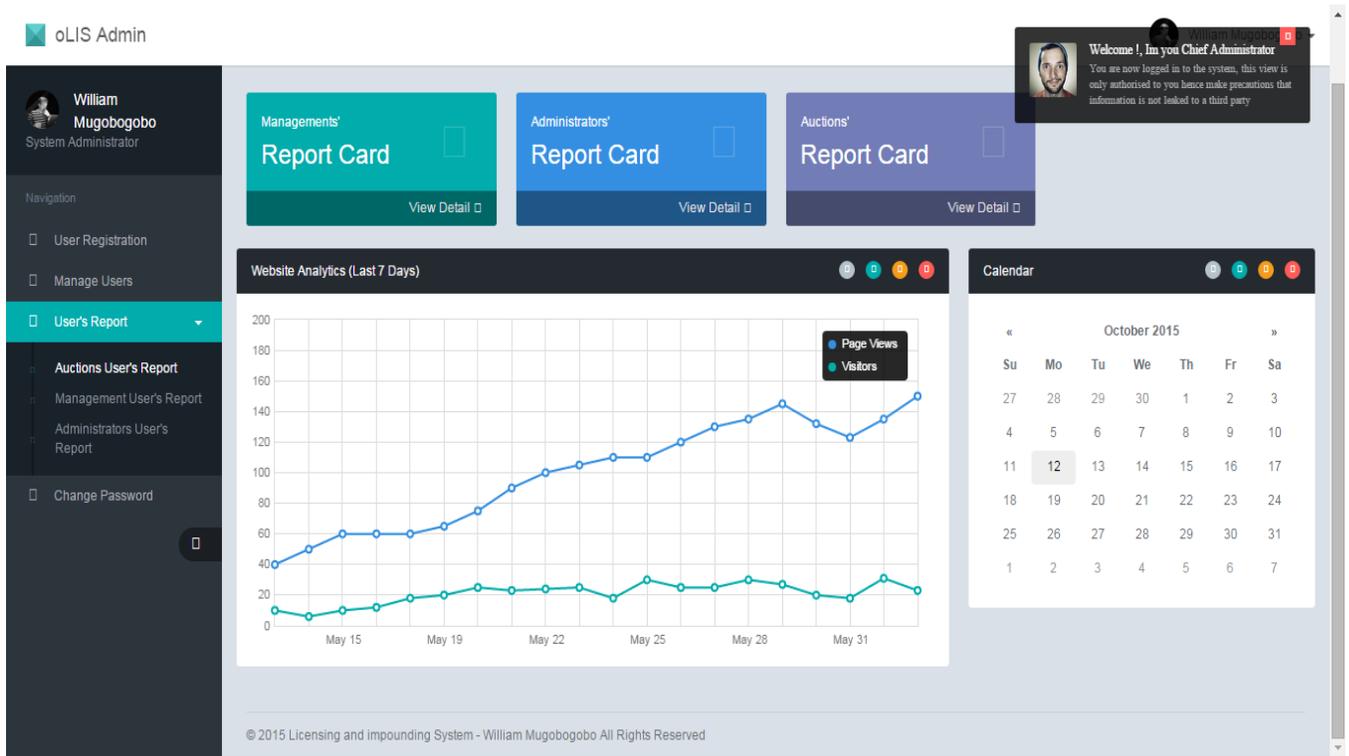
User reports can also be accessed from the user report option on the dash board.

Please ensure that you keep your password in a safe place as it is confidential and only you, as the user must use it to log on to the system

Please ensure that you logout of the system after use.

Contact the Systems Administrator on telephone number 0777 278 217, if you require any further assistance on using the system

Appendix B: Interview guide

Below is an interview transcript that the researcher compiled after he interviewed the IT administrator, licensing clerk, systems analyst and other users in the organization. Note that these questions were rephrased during compilation to produce the interview transcript for documentation purposes. The following is the interview transcript with some of the questions asked and their respective answers. Interview transcript

Q: How Efficient is the current system in management of traffic details?

A: There are so many problems with the current system and I will highlight only the major ones. The current system is monotonous in the recording of licenses, tickets and fines since we need to go through many files before updating. It is taking too much time to retrieve information about a customer record from the files. The system is also subject to human error and it ends up giving a wrong image about the organization. We are also experiencing problems of stationery costs because the system uses a lot of paperwork.

Q: How does the system work in capturing details and producing reports?

A: We go through all the files concerned and extract information we need for report generation and then we type reports using Microsoft Word.

Q: What do you suggest should be done to improve the current system?

A: I think the system needs a lot of attention, especially in the recording of details. There is need to have a computerized system in which the details can be entered efficiently and retrieved correctly.

Q: If we are to computerize the system, what do you expect from the new system?
A: Thank you for that suggestion, the new system should be able to capture and store all licensing, impound and traffic related details. It should also be able to update the details in case of a change or correction, it should provide faster retrieval of information needed. This system preferably must be able to automatically generate reports for analysis and decision making.

Appendix C: Questionnaire

The following is a sample questionnaire, which the researcher used to gather information from the company staff. Put a tick in the appropriate box for your answer.

1. Are you satisfied with the current system?

    Yes ☐

    No   ☐

2. What security problems are you facing with the current system?

    Yes ☐

    No   ☐

If your answer is No state reasons and recommendations.

……

……… …………………………………………………………………….........................

3. How do you rate the current system?

    Good ☐   Average ☐   Poor ☐

    Explain……………………………………………………………………………………

    ……………………………………………………………………………………

4. What do you consider as the main problems of the current system?

    ……………………………………………………………………………………

    ……………………………………………………………………………………

5. What do you recommend as possible solutions to the problems?

……………………………………………………………………………………....

....

6. How efficient and reliable is the manual licensing System?

……………………………………………………………...…………………………

7. In this existing system, do you do any backup?

Yes ☐

No ☐

8. How long do you take to get served by the Clerks? Are you satisfied with the duration?

……………………………………………………………………………………………
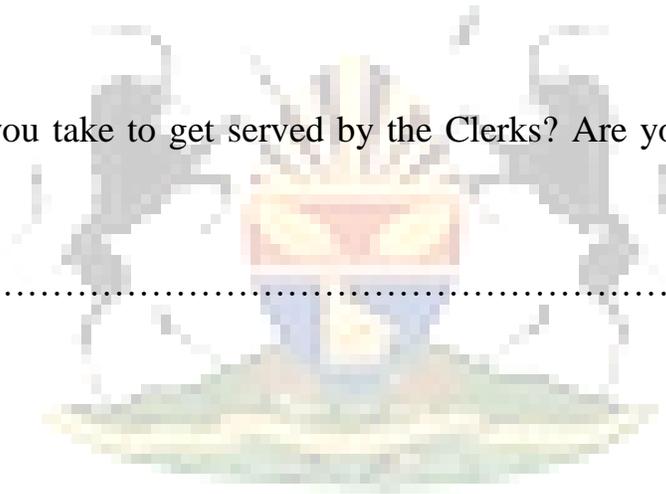
Appendix D: Observation Score sheet

Name of observant: …………………………….................

Name of observer: ………………………………………

Date: ………………….. Time: …………

Focus of observation: …………………………………………………….

Brief description of session:

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Areas of strength:

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Areas for development:

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Signed - System Administrator: ………………………….   Date ……………….

Signed - Observer: …………………………………………….   Date ……………….
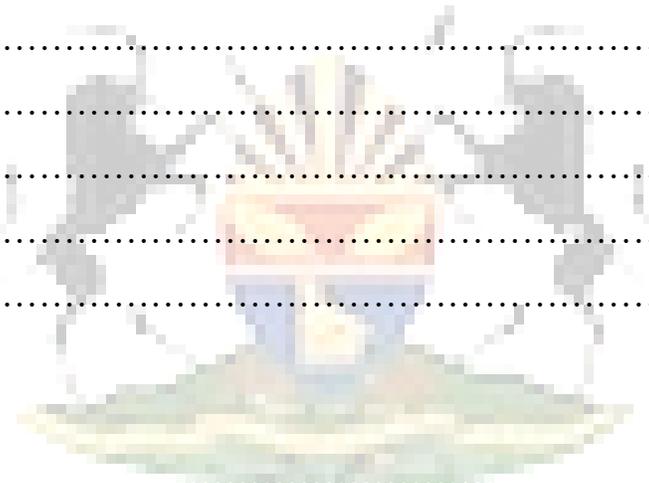
Appendix E: Code Snippet

```csharp
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using System.Data.SqlClient;
using System.Configuration;

namespace Vehicle_Licensing_Systemc
{
    public partial class License : Form
    {
        public License()
        {
            InitializeComponent();
        }

        SqlConnection con;
        SqlCommand cmd;
        private SqlDataAdapter dataAdapter;
        private DataSet ds;
        private DataTable dataTable;
        private int currRec = 0;
        private int totalRec = 0;

        private void button2_Click(object sender, EventArgs e)
        {
            City_of_Harare_Traffic_Enforcement_Department nw = new
City_of_Harare_Traffic_Enforcement_Department();
            nw.Show();
            this.Hide();
        }

        private void License_Load(object sender, EventArgs e)
        {
            // TODO: This line of code loads data into the
'vehicleLicensingSystemDataSet.Permits' table. You can move, or remove it, as needed.
            this.LicenseTableAdapter.Fill(this.vehicleLicensingSystemDataSet.Permits);
            // TODO: This line of code loads data into the
'vehicleLicensingSystemDataSet.Permits' table. You can move, or remove it, as needed.
            this.icenseTableAdapter.Fill(this.vehicleLicensingSystemDataSet.License);

        }

        private void button4_Click(object sender, EventArgs e)
        {
            if (textBox1.Text != "")
            {
                string connectionString =
ConfigurationManager.ConnectionStrings["DBCS"].ConnectionString;
```

```csharp
            con = new SqlConnection(connectionString);

            string commandString = "SELECT * FROM Registration WHERE
VehicleREgistrationNumber = '" + textBox1.Text + "'";
            dataAdapter = new SqlDataAdapter(commandString, con);
            ds = new DataSet();
            dataAdapter.Fill(ds, "Registration");


            dataTable = ds.Tables["Registration"];
            currRec = 0;
            totalRec = dataTable.Rows.Count;

            FillControls();
            button1.Enabled = true;
            textBox1.Clear();
        }
        if (textBox1.Text == "")
        {
            MessageBox.Show("Enter the correct credentials to obtain results for your
search");
        }

    }
```

CODE FOR LINKING TO THE DATABASE

```xml
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <configSections>
  </configSections>
  <connectionStrings>
    <add name="DBCS"
      connectionString="Data Source=WMugobogobo;Initial
Catalog=VehicleLicensingSystem;Integrated Security=True"
      providerName="System.Data.SqlClient" />
  </connectionStrings>
  <startup>
    <supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.5" />
  </startup>
</configuration>
```