

ZIMDEF TENANT MANAGEMENT SYSTEM



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By

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Abstract

ZIMDEF Tenant Management System is a computerized system that was developed with a purpose eliminating the problems faced by the organization when managing its tenants. The system allows ZIMDEF to advertise online the available space for rental to potential tenants. The interested tenants respond to the advert by applying for the space they want for their business purposes. The manager is responsible for accepting or rejecting the applications online. The accepted applicants are then automatically registered into the system. They will be notified via their email accounts that their applications were successful and the credentials that they will be using to access the system will also be attached in the email. The system calculates and sends the monthly bills to tenants' accounts. The tenants should make their payments through ZIMDEF bank account and then upload the proof of payment on the system. The clerk is responsible for approving the proof payments uploaded by tenants. The research instruments that were used include interviews, questionnaires and observation. A comprehensive feasibility study of the system was weighed to enable evaluation of the practicability of the system and enabling determination of the system's viability. This revealed that it was relevant to implement the new system. After the system was successfully designed, it was then tested in order to see if the user expectations were met. After system testing, the users were trained on how use the system. The system was installed on ZIMDEF servers and direct changeover strategy was used. There are various maintenance strategies to be used to make sure that the system continues to serve its purpose. The developer recommended that in future, the system must be integrated with other systems used by ZIMDEF so as to improve productivity. The system should also be made available on mobile devices to allow system users to access the system in remote places. The tools that were used to develop the system include PHP, MySQL, XAMPP and JavaScript. The system documentation was done using Microsoft word.

Declaration

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

Signature:

Date:

Approval

This dissertation, entitled “**ZIMDEF Tenant Management System**” by **Collen Musarira** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University**, and is approved for its contribution to knowledge and literary presentation.

Supervisor’s Signature:

Date:

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THROUGH CHRIST WE MOVE TO GREATER HEIGHTS

Dedication

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List of acronyms

DBMS	Database Management System
DFD	Dataflow Diagram
EERD	Enhanced Entity Relationship Diagram
ERD	Entity Relationship Diagram
HTML	Hyper Text Mark Up Language
LAN	Local Area Network
NPV	Net Present Value
PHP	Preprocessor Hyper Text
ROI	Return On Investment
RAM	Random Access Memory
SQL	Standard Query Language

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Chapter 1: Introduction

1.1 Introduction

The Zimbabwe Manpower Development Fund (ZIMDEF) is a state enterprise that owns an eight storey building and other several properties in the city of Bulawayo. ZIMDEF only uses one floor for its operations amongst its eight floors, and the rest of the floors as well as other properties are made available for tenants to rent. This is one of the ways that it uses to generate income to finance its operations. This project aims to manage the company's tenants in a more efficient and effective manner as well as allowing potential customers to apply for space to rent online, registration as well as calculate the monthly bills for tenants.

1.2 Background of the study

ZIMDEF owns several buildings in the city of Bulawayo. The company makes some of its revenue from leasing these properties to tenants. The potential tenants enquire and then apply if there is available space to rent. These applications are submitted by hand and the manager is responsible for approving or disapproving the applications. The accounts clerk will then open a flat file for each and every tenant who have been allocated space at the company premises. Each file contains the details of every tenant as well as their payment records. At the end of the month, the clerk performs the manual billing process and physically sends the invoices to the tenants. After paying their bills, the tenants then send their proof of payment to ZIMDEF and the clerk manually updates the tenants' records.

1.2.1 Background of the organisation

Zimbabwe Manpower Development Fund (ZIMDEF) is a state enterprise under the Ministry of Higher and Tertiary Education, Science and Technology. ZIMDEF has a mandate of financing the development of highly skilled human capital in Zimbabwe. ZIMDEF was formed to finance the training of apprenticeship students and to offer financial support towards tertiary training. The core business of the fund is the collection and disbursement of training levy through its offices in Harare, Bulawayo, Gweru and Mutare. The organization has a mandate of collecting 1% training levy from registered companies in Zimbabwe. This levy is ZIMDEF's major source of funding and is payable on a monthly basis. A delay in its payment attracts a surcharge and interest in terms of Manpower Act and if unpaid litigation proceedings will be taken. ZIMDEF

financed the construction of lecture rooms, libraries and learning facilities at colleges and universities as well as payment of rebates to employers who sponsor their workers who successfully completed the approved courses. It is also responsible for the funding of upgrade training courses at Msasa and Westigate vocational training center.

1.2.2 Organizational structure

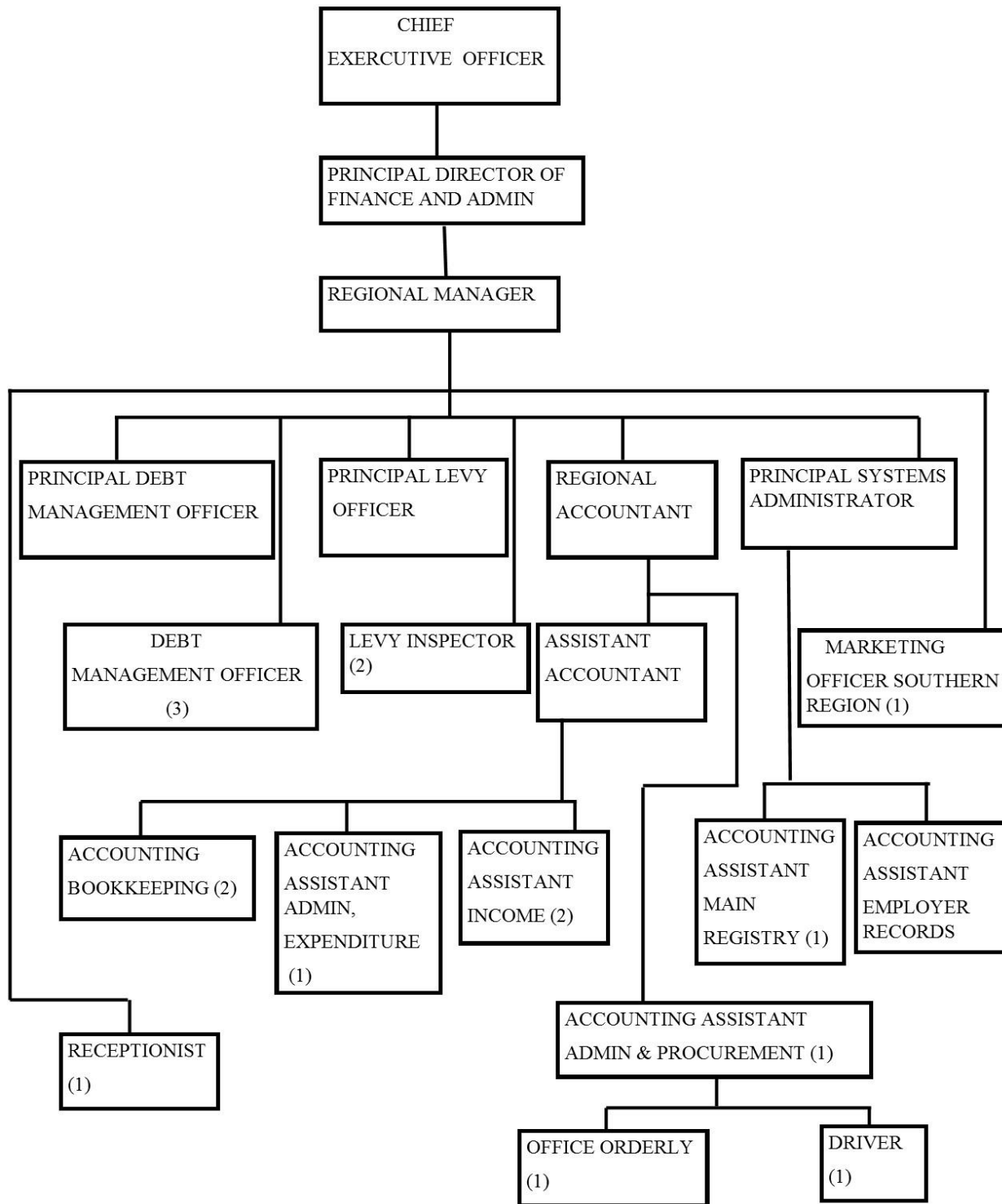


Fig 1.1 Organogram

1.2.3 Vision

To be the hub of resource mobilization for human capital development for sustaining the Zimbabwean economy.

1.2.4 Mission statement

To contribute towards national human capital development through resource mobilization, management and disbursement for the benefit of clients.

1.3 Research problem

According to Eppingner (2008), research problem is a situation that drives a scientific process and is a foundation of any research method as well as the experimental design from the true case study. ZIMDEF is a company that owns an eight storey building and other several buildings in the city of Bulawayo. The company only occupies one floor and the rest are made available for tenants to rent. The potential tenants apply for accommodation and submit application by hand. The accounts department is responsible for responding to potential tenants who want accommodation at the company premises. The accounts clerk will then open a flat file for each and every tenant who have been allocated space at the company premises. Each file contains the details of each and every tenant as well as their payment records. At the end of the month, the clerk performs the manual billing process and send the invoices to the tenants. After paying their bills, the tenants then send their proof of payment to ZIMDEF and the clerk updates the tenants' records. The problems that were associated with using the manual system were as follows:

- ❖ The invoices were physically delivered to tenants, therefore it was time consuming, stressful and inefficient way of doing business.
- ❖ Invoices send to customers may sometimes contain errors due to human errors since the billing process was done manually.
- ❖ It may take too long for applications to be approved or disapproved because the applications maybe misplaced.
- ❖ Data analysis was very difficult using the manual system.
- ❖ Searching for the tenants' records was difficult and time consuming since the files were kept in no particular order.

- ❖ It was time consuming during capturing the tenants details.

1.4 Aim of the research study

This project aims to manage the company's tenants in a more efficient and effective manner as well as allowing potential tenants to apply for space to rent online, registration as well as billing the tenants at the end of every month

1.5 Objectives of the research study

- ❖ To develop a system that allows the organization to advertise online, the available rental space to potential tenants.
- ❖ To develop a system that allows potential tenants to apply for rent space online.
- ❖ To develop a system that allows the manager to approve or disapprove the applications online.
- ❖ To develop a system that allows the registration of successful applicants.
- ❖ To develop a system that calculates the bills of the tenants and sends the invoices to the tenants.
- ❖ To develop a system that allows the tenants to upload the proof of payments online after paying their bills at the bank

1.6 Instruments and methods

For the effective completion of the proposed system the accompanying tools were be utilized:-

- ❖ **MySQL database** - is a robust and fast database that is easy to use therefore making it a popular database when working with sites that have dynamic content.
- ❖ **Hypertext Pre-processor (PHP)** – it supports the development of dynamic websites and it is easy to use hence making it an important tool.
- ❖ **Macromedia Dreamweaver 8** - is a professional tool for designing the system interface. It is easy to use as it allows the developer to drag and drop some controls on the form.
- ❖ **HTML** - is tool that is capable of integrating with PHP.
- ❖ **XAMP Server** - is a popular and easy tool used to host web based applications

1.7 Justification and rationale

- ❖ Developing a system that allows the organization to advertise will essentially diminish the work load of the employees' hence increasing productivity.
- ❖ Developing a system that allows tenants to apply online will save the tenants' time whilst waiting in a queue to submit applications and also reduce congestion at ZIMDEF offices.
- ❖ Developing a system that allows managers to approve or disapprove applications online will decrease the time spend during approval of applications and also reduce the risks of misplacing the application forms.
- ❖ Developing a system that allows the registration of successful applicants will reduce the work load of the clerk during data capturing.
- ❖ Developing a system that calculates the tenants' bills and sends the invoices to the tenants will eliminate human errors during the calculation of bills.
- ❖ To develop a system that allows the tenants to upload the proof of payments online after paying their bills at the bank will save the tenants time as well as reducing ZIMDEF storage costs for these proof of payments.

1.8 Conclusion

The introduction of the ZIMDEF Tenant Management System was seen as an exceptionally obvious move that would see the organisation accomplishing its objectives that have been set by management, but not yet been achieved because of limitations that were associated with the manual system. The new system gave a more solid stage to overcome these limitations. The end of this chapter denotes the initiation of chapter two.

Chapter 2: Planning Phase

2.1 Introduction

Planning phase is a stage where the organisation outlines all the necessary tools and timeline needed for the project development as well as analysing the feasibility of the project (Pressman 2005). This stage will subsequently give an understanding on the feasibility of developing the system. The developer undertook the feasibility study on the technical, operational, social as well as economic issues. The system that was developed will play a paramount role to get rid of the inefficiencies that were associated with using the manual system.

2.2 Business value

According to Blaxer (2006) business values is the basic criteria that administer the business operations. In most cases the core business of the organisation normally do not change as compared to the organisational plans and strategies. This feature makes it unique to its stakeholders.

2.2.1 Organisation value

According to Blaxer (2006), an organisational value is a belief that a specific mode of conduct is preferable to an opposite or contrary mode of conduct. They serve as a decision-making tool in daily interactions that guide behaviour.

- ❖ **Increased effectiveness-** The system that was developed will go a long way in ensuring high quality service delivery to ZIMDEF clients through timely responding to clients.
- ❖ **Increased efficiency** – the new system will play an important role in cutting costs associated with paperwork as well as to establish a good relationships with the tenants.
- ❖ **Productivity** – the new system will help to increase productivity through faster and accurate figures generated during the billing process. This will help to reduce the risk of under and overcharging the tenants.

2.2 .2 Customer value

According to (Hughes, 1999), customer value is the importance that is realised by the consumer of the product. The end-customers consist of several individuals or companies consuming the product or services.

- ❖ The customer will benefit a lot from the new system in the form of lower cost of delivering the application letters as well as the proof of payments.
- ❖ The customer will also benefit from the new system because there will be no more risks of being overcharged on their monthly bills.
- ❖ The new system will foster cheap and effective way of communication through the use of emails and an online platform.

2.2.3 Employee value

An employee value is an understanding between an organization and its employees on what the business will provide in exchange for the productivity, dedication, and engagement of its employees (Boem, 2000).

- ❖ Reduced boredom – the new system eliminated boring activities such as searching and updating the records of a particular tenant.
- ❖ Reduced errors – the new system made life easier for the employee because there will be no more manual calculations of tenants' bills.
- ❖ Reduced work overload - The employee will execute the task by just a click of a button on the system, therefore will lead to faster execution of tasks. This will allow the employee to complete other different activities assigned to them by their supervisors.

2.2 .4 Managerial value

According to Rossengren (2000), management value has been regarded as following the people oriented principle.

- ❖ The system was developed with a purpose of enabling the management to control their job so that it becomes easy to manage the tenants.

2.3 Feasibility Analysis

According to Wolf (2013), feasibility study is the practice where by the analyst assess whether it is viable to develop the new system or not. At this stage the analyst must consider all the required resources to ensure the success completion of the project. Kendall and Kendall (2011) also argued that this is a phase where the project members need to gather required information that help the organisational management to choose if the system development must proceed if it benefits the organisation.

At this section the analysts looked at the required resources and obstacles which may disturb the project success. This means that the expenses and benefits that were as a result of developing the new system were identified and aided in the decision making process on whether it was rational to carry out the project or not. The analyst has proven to the organisation that the system development will be viable through carrying out technical feasibility, economic, social and operational feasibility.

2.3.1 Technical feasibility

According to Kendall and Kendall (2007), technical feasibility is whereby the analyst measure the capacity of the organisation to carry out the system development in terms of availability of resources and expertise. According to Valacich et al (2012), technical feasibility is assessing the capacity of the system developers to effectively use the available resources. They also emphasised that the project members must consider the compatibility of the system to be developed using the available resources. The existence or non-existence of the resources guided the organisation on the costs that are associated with project development. Developers took into consideration that the hardware and software components vary in terms of compatibility with the system to be developed. For an in-house software development to occur then the following questions should be answered:

- ❖ Are the necessary resources and expertise available?
- ❖ Does the organisation has the capacity to carry out an in-house development?
- ❖ Is the new system a solution to the existing problem?

2.3.1.1 Technical expertise

In this section the analyst must show the availability of technical skills that are needed during the

system development (Yeats and Wakefield, 2004). The developer is required to possess various technological skills that are necessary to carry out the project Ibid In this case the developer was well versed with the required skills which include MySQL, PHP, HTML, Xampp and Dreamweaver.

2.3.1.2 Software and hardware requirements

The analyst focused on the software and hardware requirements of the new system. These requirements were outlined below and the analyst also indicated whether they were available or not. If they were not available then the analyst had to make sure that they were acquired.

Table 2.1 Hardware and software requirements

Item	Item Description	Quantity Required	Quantity Available
Core i7 Laptops	4GB RAM, 500GB HDD	2	2
Network Gateway	USSD Gateway	1	1
Windows Server 2012	Real Time Back-end Database	1	0
Server Machine		1	0
Uninterrupted Power Supply	5500 Watts	1	0
Switch		1	1

Overview of economic feasibility

The management promised to acquire the unavailable hardware and software requirements by setting aside enough finances to purchase them soon after the system development started. After an in-depth analysis of technical expertise and other requirements the analyst concluded that ZIMDEF was capable of carrying out an in-house development.

2.3.2 Economic feasibility

The analyst must weigh the expected costs against the benefits and indicate if the project must proceed or not (Woods and Sangster, 2005). In addition, Lucy (1996) defined economic feasibility as an evaluation of the benefits to be enjoyed as a result of the implementation of the new system compared to costs of the project. If the system shows more benefits compared to development expenses then the project is said to be economically feasible. The analyst used a method called the cost benefit analysis to compare the costs and benefits associated with project development. This analysis was used to find out if the project is economically feasible. Economic feasibility gave an assurance to the analyst that the organisation will benefit from the project.

2.3.2.1 Cost benefit analysis

This is a method that is used to identify all the costs as well as the benefits that are associated with project development (Randal, 1996). These costs and benefits to be accrued are then expressed in monetary terms. This analysis indicate the benefits that the organisation will enjoy as a result of the implementation of the new system. However there is a challenge in quantifying these benefits in monetary values.

2.3.2.2 Costs

These are the cash out flows and expenses that were incurred during the system development. According to Drury (1997), costs are the finances that are sacrificed by the organisation during the implementation of the project. These costs must be assigned to the specific item or activity and then expressed in monetary terms.

2.3.2.3 Development and operational costs

According to Resengren (2000), development costs are the costs experienced during the project development for instance the costs experienced when undertaking the research as well as acquiring hardware and software. Satzinger (2012) explained that these are costs that are experienced from the start of the project to the implementation phase. Tables below shows the summarised costs of system development.

Table 2.2 Developmental costs

Development cost	2017
Currency	US\$
Uninterrupted Power Supply	300
Server Machine	1500
Windows Server 2012	300
Research and travel	500
Communication	300
Printing and photocopying	350
Total development cost	3250

Table 2.3 Operational costs

Operational costs	2017	2018	2019
Currency	US\$	US\$	US\$
Server upgrades	1200	600	500
Training cost	600	200	150
Maintenance	800	400	300
Further research	200	100	70
Stationary	500	200	150

Software licence	300	200	150
Analyst programmer	500	300	300
Total operational cost	4100	2000	1620

2.3.2.4 Benefits

Benefits are positive results that an organisation enjoys after carrying out a certain project (Lucey, 2006). To add on, benefits are an additional value that is gained from the completion of a project Ibid. These benefits are classified into two categories namely tangible benefits and intangible benefits.

2.3.2.4.1 Tangible benefits

Tangible benefits are known as the advantages that are put in monetary terms Ibid. These are advantages that are enjoyed by an organisation for implementing a new system. The benefits can be calculated in monetary values. Below is a table that shows the tangible benefits that will be obtained by ZIMDEF:

Table 2.4 Tangible benefits

Year	2017	2018	2019
Currency	US\$	US\$	US\$
ITEM			
Reduction of stationary cost	700	1300	2100
Reduced transport cost	600	700	900
Reduction in operational cost	1200	2000	4000
Total Benefits	2500	4000	7000

2.3.2.4.2 Intangible benefits

These kind of benefits are difficult to put in monetary terms yet they are of paramount importance to the organisation (Shelly and Rosenblatt, 2010). According to Yeats (2004), intangible benefits are subjective because they cannot be measured with precision.

Table 2.5 Intangible benefits

Year	2017	2018	2019
Currency	US\$	US\$	US\$
ITEM			
Improved productivity	400	800	1500
Reduced work load	500	1000	1500
Efficient tenant management	800	1000	1500
Total Benefits	1700	2800	4500

Table 2.6 Cost Benefit Analysis

Year	2017	2018	2019	Total
Currency	US\$	US\$	US\$	US\$
Tangible benefits				
Reduction of stationary cost	700	1300	2100	4100
Reduced transport cost	600	700	900	2200
Reduction in operational cost	1200	2000	4000	1800
Total tangible benefits	2500	4000	7000	13500

Intangible benefits				
Improved productivity	400	800	1500	2700
Reduced work load	500	1000	1500	3000
Efficient tenant management	800	1000	1500	3300
Total intangible benefits	1700	2800	4500	9000
Total benefits	4200	6800	11500	22500
Development cost				
Uninterrupted Power Supply	300	200	100	600
Server Machine	1500	1000	500	3000
Windows Server 2012	300	200	100	600
Research and travel	500	300	100	800
Communication	300	200	100	600
Printing and photocopying	350	300	200	850
Total development cost	3250	2200	1100	6550
Operational costs				
Server upgrades	1200	600	500	2300
Training cost	600	200	150	950
Maintenance	800	400	300	1500
Further research	200	100	70	370
Stationary	500	200	150	850
Software licence	300	200	150	650
Analyst programmer	500	300	300	1100
Total operational cost	4100	2000	1620	7720

Total cost	7350	4200	2720	14270
Net benefits/(costs)	(3150)	2600	8780	8230

2.3.2.5 Return on investment

Return on investment is a technique that is used to assist the analyst in calculating the efficiency and effectiveness of the project (Randall, 1996). It is calculated using the following formula:

$$\text{R.O.I} = \frac{(\text{Total Benefits} - \text{Total Cost}) * 100\%}{\text{Total Cost}}$$

Total Cost

$$\text{R.O.I} = \frac{(22500 - 14270) * 100}{14270}$$

14270

$$\text{R.O.I} = \frac{(8230) * 100}{14270}$$

14270

$$\text{R.O.I} = 57.7\%$$

Advantages

- ❖ It is simple to make calculations using ROI.

Disadvantages

- ❖ It is not a reliable technique to use as it might mislead during the decision making process.
- ❖ The degree to which ROI overstates the underlying economic value depends on the life span of the project, hence the longer the lifespan the more chances ROI is going to be overstated.

Comment

Basing on the calculations above, the project was economically feasible since it is going to return \$0.57 per each dollar invested.

2.3.2.6 Net present value

Net Present Value (NPV) is an accounting ratio which takes into consideration the value of money today compared to the return of the money at different periods. NPV is regarded as the difference between the present value of cash inflows and the present value of cash outflows. A positive NPV indicates that the earnings realised from the project outweighs the costs. A project that has a positive NPV will be profitable to the organization and the one with a negative NPV indicates a loss if implemented. The formula below is used to calculate the NPV:

$$\text{Present Value} = \frac{1}{(1+r)^t}$$

Where r = discount rate and t = time (in years)

Table 2.7 Net present value

Year	Discount factor (10)	CF	PV
2017	0.909	(3150)	(2863.35)
2018	0.826	2600	2147.6
2019	0.751	8780	6593.78
Net Present Value			5878.03

Advantages

- ❖ It considers time value for money.
- ❖ It focuses on the profitability of the project.

Disadvantages

- ❖ Coming up with a suitable discount rate is more of a challenge.

Comment

Basing on the NPV calculations above, the project has proven to be feasible since it had a positive value of \$5 878.03 using a 10% discount rate.

Overview of economic feasibility

After a thorough project analysis it was noted that the project was economically feasible since the benefits outweighed the costs.

2.3.3 Social feasibility

According to Larson and Gray (2011), social feasibility refers to the evaluation of social and cultural practices, beliefs and status that is likely to be affected by the new system development.

2.3.3.1 Management

The top management of the organisation viewed the project as guide in accomplishing their strategic goals that include cutting costs as well as improving tenant management. The system in this manner was seen as a step further in achieving the goals of the organisation. The new system will facilitate the smooth running of the business.

2.3.3.2 Employees

The employees of the organisation are the key stakeholders of the system and how they see the system is of principal significance (Berndtsson, 2008). The employees viewed the system playing the paramount role in reducing their burden during their operations. They also viewed it as a tool that will play a major role in improving their personal knowledge on the use of new technology. They have been in full support of the idea of implementing the new system.

2.3.3.3 Tenants

The tenants' viewed the new system as a major improvement as it will ensure improved services. They viewed the system as a cost cutting tool as well as an efficient and effective tool for communication purposes. They also viewed the system as a tool that produces an error free information thereby producing the actual rental bills. Basing on the analysis above, it was concluded that the new system is socially feasible since the users were keen to see the system implemented.

Overview of social feasibility

The project was socially feasible since it was welcomed by all the users since it will play a major role in eliminating the challenges that were faced using the manual system.

2.3.4 Operational feasibility

According to Stoner (2000), operational feasibility is a study conducted to figure out if the new system will satisfy the business needs. This study will clearly layout if the new system implemented will be operationally workable as well eliminate the inefficiencies after it has been implemented Ibid. In order for the system to be regarded as operationally feasible it has to satisfy the business needs and stakeholder needs. Operational feasibility determine whether the system users have the knowledge and capacity to use the system (Valacich et al, 2012).

At this stage, questions may arise to see whether the system will be accepted by various stakeholders. According to Valacich et al (2012), if all the stakeholders accept the new system then the system is said to be operationally feasible. The system development was invited by all the stakeholders involved because of its usefulness to their operations since it will be faster and accurate when processing the information. After the system development the developer will then train all the system users on how to use the system so as to reduce errors as well increasing their productivity.

Overview of operational feasibility

The new system was invited by all the stakeholders involved because of its usefulness to their operations since it will be faster and accurate when processing the information. The new system was seen to ease the way of doing business hence it was operationally feasible.

2.4 Risk analysis

Risk analysis is referred to the prediction of some potential dangers that may hinder the project (Stomel and Willis, 2004). Therefore it is necessary to take actions to avoid any loss or failure that may occur. The system analyst must take into account the risk that may hinder the success of the system development and take measures to avoid them before the system is implemented Ibid. Some of the risks that were identified are as follows:

- ❖ **Technical risk:** This type of risk occurs when the users of the system don't have necessary skills and knowhow on how to use the new system. This may lead to them being resistant to use the new system (Boem, 2000). The project members were fully aware of all these risks and they have put measures in place to encounter them. They suggested that they will conduct training and workshops to help the users on how to use the system. This will be done before the project is implemented. This training will ensure that users familiarise and become knowledgeable on how to use the system. This will go a long way in increasing the productivity of the workers hence promote smooth running of the business.

- ❖ **Stakeholder risk Analysis:** This focuses on both the internal and external stakeholders of the company and they are affected by the decisions that are undertaken by the organisation. These stakeholder are individuals or organisations that have an interest in the operations of the business. The stakeholders in question include the employees, management as well as tenants. The project members worked hand in hand with these stakeholders in communicating the progress of project development. Failure to communicate well may lead to resistance from these stakeholders. Therefore as a measure to encounter this risk, project members decided to communicate the progress of the project on a weekly basis as to keep them well informed.

- ❖ **Monetary Risk:** Faced with the current financial challenges in our economy there was need for a sound financial plan that to act as a counter measure to cater for the cash crunch that may threaten the success of the system development. In this case the organisation put aside the financial backup plan to support the project till its completion.

2.5 Stakeholder Analysis

Stakeholder analysis is about identifying the people or organisations that are affected by the project (Roede, 2011). This is also a process of resolving the conflicts among the stakeholders. In addition, Duffy (2011) stated that it is a process to collect data and estimate what is required by the stakeholders in their best interest.

2.5.1 Organisation

It was anticipated by the organisation that undertaking the project is a more prominent strategy that will enable ZIMDEF to gain the competitive advantage over its competitors. ZIMDEF was in full support of the idea therefore it made sure that all the resources needed for the success of the project were secured.

2.5.2 Management

Management expectations from the new system were that the system should facilitate good management of the company tenants. They expected that there should be quick responds to the tenants needs. In addition, they also expected the system to play a fair game with the tenants in the form of calculating the accurate bills, and not overcharging them. Moreover, eliminating the challenges that were identified in the problem definition was another management expectation.

2.5.3 Employees

The major expectations of the employees were that the system should reduce work load. Therefore the system must allow fast and easy execution of tasks as this will allow them to complete other different activities assigned to them by their supervisors. They also expected that the new system must eliminate boring activities such as searching and updating the tenants' records. To add on, the system must play a major role in reducing human errors. They also expected that the system must make life easier for them by eliminating the manual operations.

2.5.4 Tenants

Tenants also expected the system to allow them to apply for space to rent online. They also expected the system to ensure quick responds when they apply for space. In addition, they also expected the system to produce accurate figures for their rental bills. They also anticipated the system to allow them to upload proof of payments online.

2.6 Work plan

It is an evaluation of how the system can be separated into little reasonable tasks amid its course of development (Duffy, 2011). To add on, Ibid portrayed a work plan as a task which is broken down into a series of atomic parts that can be completed on specific period showing how a

specific task will be completed. Below is a work plan that shows the tasks and their expected time frames.

Table 2.8 Work plan

ACTIVITY	START DATE	END DATE	DURATION (Weeks)
Proposal	14/08/2016	21/08/2016	1
Planning	22/08/2016	05/09/2016	2
Analysis	06/09/2016	20/09/2016	2
Design	21/09/2016	19/10/2016	4
Implementation	21/03/2017	19/04/2017	4
Maintenance	20/04/2017	Ongoing	1++
Documentation	14/08/2016	Ongoing	13++

2.6.1 Gantt chart

A Gantt chart is a diagrammatic representation demonstrating activities related to the project and their planned time period they ought to be finished (Pressman 2011). According to Duffy (2011) a Gantt chart is utilized for tracing the planned activities of the project. It allows people to see

when each task start and end. It also show how long the activity will take to be completed. Below is a Gantt chart that shows the time frame scheduled for each activity and their expected finish time.

Table 2.9 Gantt chart

Activity	Period (Weeks)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Proposal	█													
Planning		█	█											
Analysis				█	█									
Design						█	█	█	█					
Implementation										█	█	█	█	
Maintenance														█
Documentation	█	█	█	█	█	█	█	█	█	█	█	█	█	█

2.7 Conclusion

This phase exhibited that the new system will be of great value to ZIMDEF by virtue of the benefits to be recognized when it is implemented. After carrying out the feasibility study it was supported that the analyst must proceed to the next phase. The completion of this chapter marks commencement of the analysis phase.

Chapter 3: Analysis Phase

3.1 Introduction

This phase concentrated on how the current system works so as to enable the developer to come up with the system that will eradicate the challenges that are associated with using the manual system. Data on how the current system operates was gathered using various methodologies that will be discussed later. This section also covers various things such as the analysis of the current system, its weaknesses, requirements analysis as well as the evaluation of alternatives. This phase helped the analyst to have an in-depth understanding of how the current system works so that the new system will address the problems associated with using the manual system.

3.2 Information gathering methodologies

It is important for the analyst to gather enough information which is useful in the implementation of the new system. The analyst must have a full understanding of how the current system works before the new system development (Barlett, 2004). To add on, Ibid also encouraged that the analyst to use various data gathering techniques to obtain information from the users. The main focus of this section was to understand the operations of the current system through the uses of various techniques such as interviews, observation and questionnaires.

3.2.1 Interviews

Interview refers to a two way oral communication or conversation between the interviewer and the interviewee (Sharan, 2009). This conversation allows the analyst to probe the users of the current system so as to obtain necessary information that is useful during the system development. Ibid stated that interviews are primary techniques used in the analysis phase for data collection. The major role played by interviews were that they allow the analyst to get clarification on grey areas.

At the point of conducting interviews there were various areas in which the analysts looked into. The analyst concentrated on structured and unstructured interviews. Structured interviews have predetermined questions and the analyst must not stray from the schedule whilst unstructured interviews do not have pre-determined questions hence unplanned. Management and few

employees were selected by the analyst for interviews. The interviews were conducted at the ZIMDEF offices in the city of Bulawayo. The major goal was to have a clear understanding of how the manual system worked as well as the problems faced by the system users. The ZIMDEF management awarded the analyst an opportunity to carry out the interview and the responds from the interviewees were recorded.

3.2.1.1 Advantages of interviews

- ❖ The analyst was given a chance to further probe the interviewees in areas that were not clear.
- ❖ The analyst obtained first-hand information from the interviewees.
- ❖ Also the analyst got immediate response from the interviewees

3.2.1.2 Disadvantages of interviews

Interviews were time consuming in the sense that the analyst had to wait the whole day since some users were busy with their work.

- ❖ The analyst noted that some of the users were reluctant to give more information on other questions since they were afraid that they might violate the organizational policies through exposing confidential data.
- ❖ The analyst was instructed to interview a limited number of interviewees therefore he got limited data.

3.2.1.3 Findings from interviews

Being done with the interviews and the analysis process, below are the findings that were noted by the analyst:

- ❖ Tenants were inconvenienced during the submission of proof of payments since they were advised to bring their proof of payments during the working hours.
- ❖ Application forms of potential tenants were sometimes misplaced thereby taking it too long to be processed.
- ❖ Tenants were sometimes overcharged or undercharged due to human errors made by the clerk during the billing process.

3.2.2 Observations

This is a technique used by the analyst during the data gathering process. The analyst did not interact directly with the users but he recorded the facts and the behaviour of the users. Whitten (2003) explained that the analyst has to make sure that data gathered from observation should be accurate and detailed so as to avoid problems in coming up with the conclusion or analyzing the results. The analyst used both types of observation which are covert and overt. Covert is a situation where by one is aware that he/she is under observation whilst overt observation is whereby one is not aware that he/she is under observation. The analyst managed to carry out the observation and also had an appreciation on how the current system works. The analyst also noted the problems being faced by the users of the system. The results obtained from observation will go a long way in complementing the other methodologies.

3.2.2.1 Advantages of observations.

- ❖ There were areas that the interviewees did not give full information during interviews and questionnaires but after observations were conducted the interviewer obtained detailed information.
- ❖ The analyst did not interfere or interrupt with the system users' operations hence did not reduce the productivity of the user.
- ❖ The analyst was able to note and jot all the system inputs, processes, entities and outputs.

3.2.2.2 Disadvantages of Observations

- ❖ It was time consuming and tiresome since the analyst had to observe the various users.
- ❖ Once the users noticed that they are being observed they tend to exaggerate their performance for instance the billing process, hence leading to the analyst missing the crucial events and collect biased data.

3.2.2.3 Findings from the observations

- ❖ ZIMDEF lost many potential tenants since some of the tenants were not patient enough to wait in a queue to submit the application forms hence prompting them to look for other places to rent elsewhere.
- ❖ It was difficult for the clerk to search for the record of a particular tenant because they were stored in a flat file with no particular order.

3.2.3 Questionnaires

Questionnaires are referred to as data gathering techniques used by the analyst whereby the respondents are given documents to fill in the questions listed (Churchill (2002). Sharan (2009) explained that questionnaires are designed with an objective of obtaining exact data about an applicable research area so as to satisfy a certain need. The questionnaires are made up of open ended and close ended questions. Open ended questions allows the respondent to fill in the answers on the space provided. Close ended questions allows the respondent to choose the answer from the listed answers. The researcher used a combination of both open and close ended questions. The analyst managed to distribute a total of twenty questionnaires and ninety per cent of the questionnaires were returned. Ninety five percent of the returned questionnaires supported the implementation of the new system and five percent were not supporting the idea since they were fearing that they might lose their jobs.

3.2.3.1 Advantages of questionnaires

- ❖ It is the simplest way of gathering information since the analyst had to give them questionnaires so that they can fill in during their own spare time.
- ❖ This technique made it easier for the analyst to quantify some results obtained from the respondents.

3.2.3.2 Disadvantages of questionnaires

- ❖ When the analyst was analyzing the questionnaires he noted that some respondents did not fully understand the questions prompting them to leave blank spaces.
- ❖ It was difficulty for the analyst to figure out if the results on the questionnaire were answered in good faith.
- ❖ Some questionnaires were not returned therefore forcing the analyst to conclude the results basing on a limited number of questionnaires.

3.2.3.3 Findings from questionnaires

- ❖ It was an inefficient and ineffective way of doing business as the tenants have to wait in a long queue in order to submit application forms and proof of payments.
- ❖ It was difficult to produce reports using the manual system.

- ❖ Some records were not up to date because the necessary documents were sometimes misplaced.

3.3 Analysis of the current system

Black (2014), stated that system analysis focus on the system operations and the weaknesses of the current system. At this section the analyst get to know the current system processes with the purpose of achieving a particular goal. This analysis is done prior the development of the new system *ibid* . It's very crucial to understand how the current system works before one implements the new system. The analyst at this point must be able to identify the system inputs, processes and output.

3.3.1 Description of the current system

The tenants who wanted to rent space at ZIMDEF had to write and submit the application forms in a sealed envelope. The manager had to approve or disapprove the applications. The successful applicants were then informed by telephone to pay for their rentals before they occupy the space. Once the payment has been made then the clerk had to capture the payment details and store all the information pertaining to the tenant in a flat file. At the end of each month the clerk prepared the invoices for all the tenants and deliver to them by traditional means. After the tenants made their rental payments through the bank then they had to submit the proof of payment to ZIMDEF. After receiving the proof of payment, the clerk will then update the records of the clients.

a) Inputs

Inputs include capturing of raw data into the system thus according to (Valacich, 2012). These inputs have to be sufficient enough so that they can be used to produce meaningful information *Ibid*. Below are the inputs of the current system:

- ❖ Application details
- ❖ Proof of payment

b) Processes

According to Satzinger (2012) a process is a state of modifying or transforming data into meaningful output. These are also activities that are performed to transform data and store it in a desired location. The current system processes are shown below:

- ❖ Application details
- ❖ Approve or disapproval of applications
- ❖ Feedback
- ❖ Rental payments
- ❖ Registering tenant
- ❖ Calculate rental bills for the tenants.
- ❖ Update tenants' records after making payments.

c) Outputs

This is whereby the system communicate the results of its data processing (Duffy, 2011). Data will be converted into information that is useful to the user. Below were the system outputs:

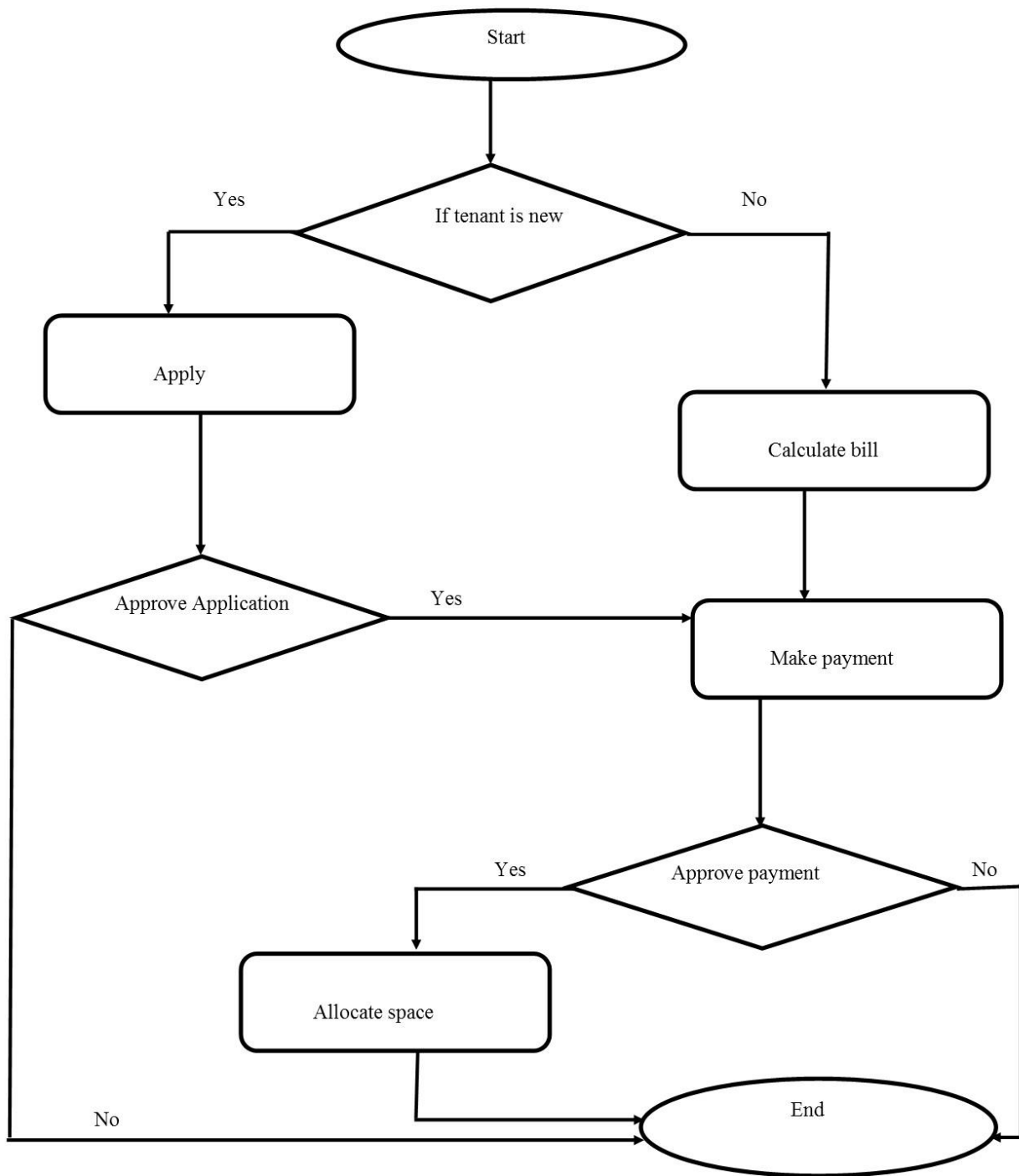
- ❖ Reports
- ❖ Invoices

3.4 Process analysis

According Sommerville (2011), process analysis is a research carried out by the analyst in order to have an in-depth understanding on how the development of the new system aim to accomplish, some important parts, structures as well as how the system developer aims to succeed. In some cases process analysis is referred to as a logical sequence of related events which can transform the input into meaningful output that is of value to the user.

3.4.1 Activity diagram of the current system

Activity diagram is a pictorial representation that shows the workflow behavior of the system activities (Chang (2005). Sommerville (2004), stated that the system activities are regarded as the operation of the system showing the order of these activities so as to give a clear picture of the sequence of activities in the system.



Key

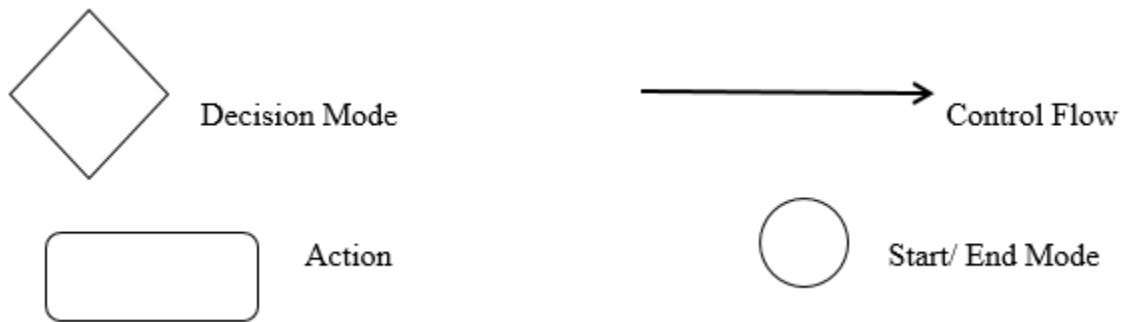


Fig 3.1 Activity diagram

3.5 Data analysis

According to Churchill (2002), data analysis is a process whereby the analyst try to derive the meaning from the data obtained using various methodologies. The main aim of this process is to highlight the valuable data through data modelling, inspection and transformation with the aim of generating the output that is of value to the organization (Satzinger, 2012). Data flow diagrams are used so as to have an appreciation of how the current system works.

3.5.1 Context diagram of the current system.

According to Kendall (2002), context diagram is a graphical representation that shows the system's high level design. It shows the system boundary and environment. Its major goal is to focus on the external entities and the system events. The diagram pictures the system at the center without showing its internal structure then surrounded by its entities and events. The diagram below shows a context diagram.

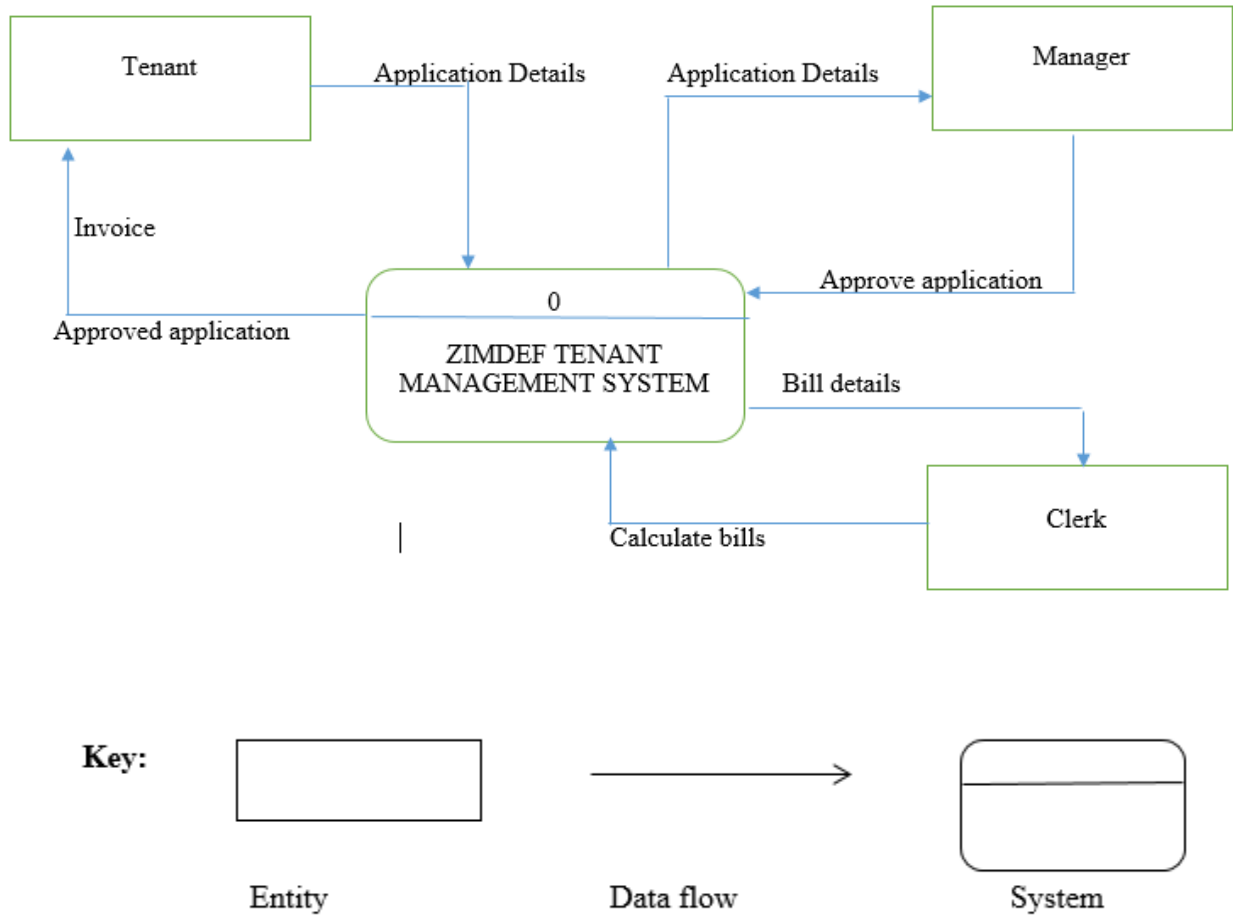
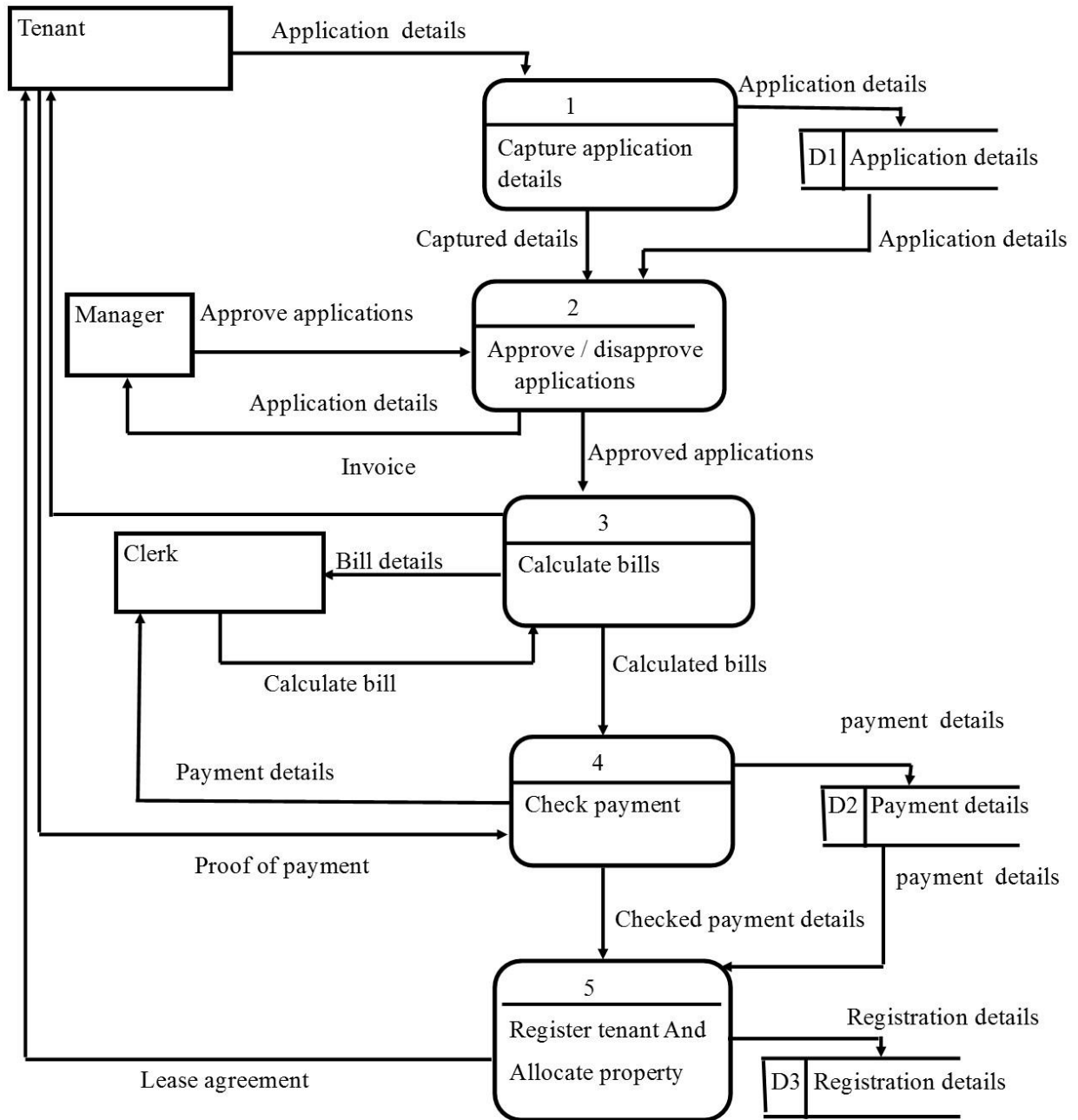


Fig 3.2 Context diagram

3.5.2 Data flow diagram of the current system

It is a graphical representation that shows how data moves in a system (Whitten (2003)). Data flow diagram shows various features of the system such as the system entities, inputs, processes, data stores and outputs. This diagram enables the analyst to have an understanding on how the current system works since it illustrates the interaction of entities as well as the flow of data in the system Ibid.



Key

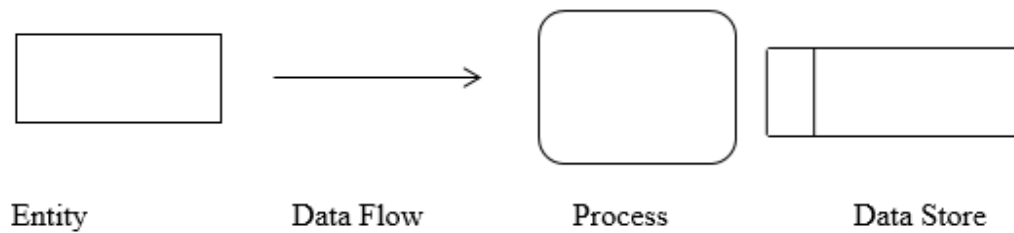


Fig 3.3 Data flow diagram

3.6 Weaknesses of the current system

- ❖ The invoices were physically delivered to tenants, therefore it was time consuming, stressful and inefficient way of doing business.
- ❖ Invoices send to tenants sometimes had errors due to human errors since the billing process was done manually.
- ❖ It took longer for applications to be approved or disapproved because the applications were sometimes misplaced.
- ❖ Data analysis was very difficult using the manual system.
- ❖ Searching for the tenants' records was difficult and time consuming since the files were kept in no particular order.
- ❖ It was time consuming during capturing the tenants' details.

3.7 Evaluation of alternatives

This is a point where by the organization is faced with various alternatives and it has to select the best alternative which utilise the available resources in terms of time and finance. When choosing the best alternative the organization has to take into consideration, the merits, demerits and costs of each alternative. It also has to consider the alternative that best fulfil the organizational needs. Out sourcing, in-house development and improvement of the current system are the alternatives that the organization is faced with. These alternatives are discussed below:

3.7.1 Outsourcing

Out sourcing is whereby the organization contracts an external developer to come up with a software product (Krugman (2009). Valacich et al (2012) explained out sourcing as a contractual agreement entered into between the organization and the skilled external developers during the software development. This enables the organization to concentrate its efforts on the area of expertise.

Advantages

- ❖ This method reduces the organizational risks since it is shifted to the contracted organization
- ❖ System development time is shorter as compared to in house development.

Disadvantages

- ❖ This method is the most expensive among the other alternatives.
- ❖ In some cases some of the requirements of the user may not be taken into consideration.
- ❖ The system may face resistance if the users' needs were not addressed.
- ❖ There is high risk of exposing organizational data.
- ❖ There is high risk that external developers may leave loop holes on the system so that they may temper with the system in the future.

Reasons why not chosen

ZIMDEF was unable to afford outsourcing since it was the most expensive alternative. Outsourcing posed the risks of security treats to the organization since the developers might leave loop holes on the system that may enable them to gain access to the system. There is no ownership of software copyrights to an outsourced program and the renewal of the license becomes a liability to the organization.

3.7.2 Improving the current system

According to Duffy (2011), improvement of the current system is a process whereby the proposed system requirements are assessed then used to alter the current system. In this case it is

of no value to improve the current system since it is inefficient and also has many challenges that are prompting the need for computerisation of the system.

3.7.2.1 Advantages of improving

- ❖ There are lower costs to be incurred
- ❖ There is also less development time required as compared to inhouse development.
- ❖ The experience of the workers will be increased since they are putting hands on the process.
- ❖ There are less chances of facing resistance by the users since they are familiar with system though fewer changes have been made.

3.7.2.2 Disadvantages of improving

- ❖ The major problems being currently faced cannot be removed by improving the current system.
- ❖ It is irrational to improve the current system because it is difficult and complex.

Reasons why not chosen

Improving the manual system was of no value since it was unable to eliminate the problems that were faced using the manual system. Improving the current system meant that ZIMDEF will continue losing customers to other competitors hence losing revenue.

3.7.3 In-house development

According to Krugman (2009), in-house development is where the organization utilizes its existing skilled ICT staff in coming up with a new system. The development team will come up and develop the system from scratch until it is fully operational. Their major goal will be to eliminate the problems that are currently faced by using the manual system. They are expected to meet all the user requirements.

Advantages

- ❖ This methods is associated with cheap system maintenance.
- ❖ This is a cheap method since the developer is on the payroll already.
- ❖ It boosts the expertise and skills of the available staff in the ICT department.

- ❖ The organization has the privilege to keep all the rights of the software.
- ❖ Improves employee morale since the system is the product of their work.

Disadvantages

- ❖ The time frame of the system development is quiet long
- ❖ Sometimes the documentation may be incomplete.

3.7.4 Recommended alternative

After carrying out a thorough assessment of various alternatives mentioned above, the analyst concluded that the in-house software development was the best practice among all the software development methodologies. It was the best option considering the constraints available, costs and benefits. The following table shows that the in house development was the most appropriate strategy in terms of costs as compared to others.

Table 3.1 Cost based justification.

Description Cost	Alternatives		
	In-house	Outsourcing	Improvement
Price of software	-	8000	-
System development	2100	-	2800
Training	1000	2000	800
Maintenance	2000	300	1900
Total Cost	5100	10300	5500

Below are the reasons why in-house development was chosen:

- ❖ The expertise required during the system development was available as it was mentioned in chapter two.
- ❖ Improving the current system was impossible as this will lead to a complete new system since there were some processes that must be removed.

- ❖ The costs associated with in-house development were relatively cheaper as compared to other alternatives as this was proven by the table above.
- ❖ A thorough research was done by the analyst therefore there was a guarantee that a high quality system that addresses the needs of the customers was to be produced.
- ❖ It helped to improve the expertise of the company ICT staff.

3.8 Requirements analysis

This is the assessment of the proposed system in order to know how the new system is expected to behave (Pressman, 2005). At this stage the developer knows the behavior of the new system. Users also must be allowed to forecast the behavior of the new system. Under analysis requirements the analyst will focus on the functional and non-functional requirements.

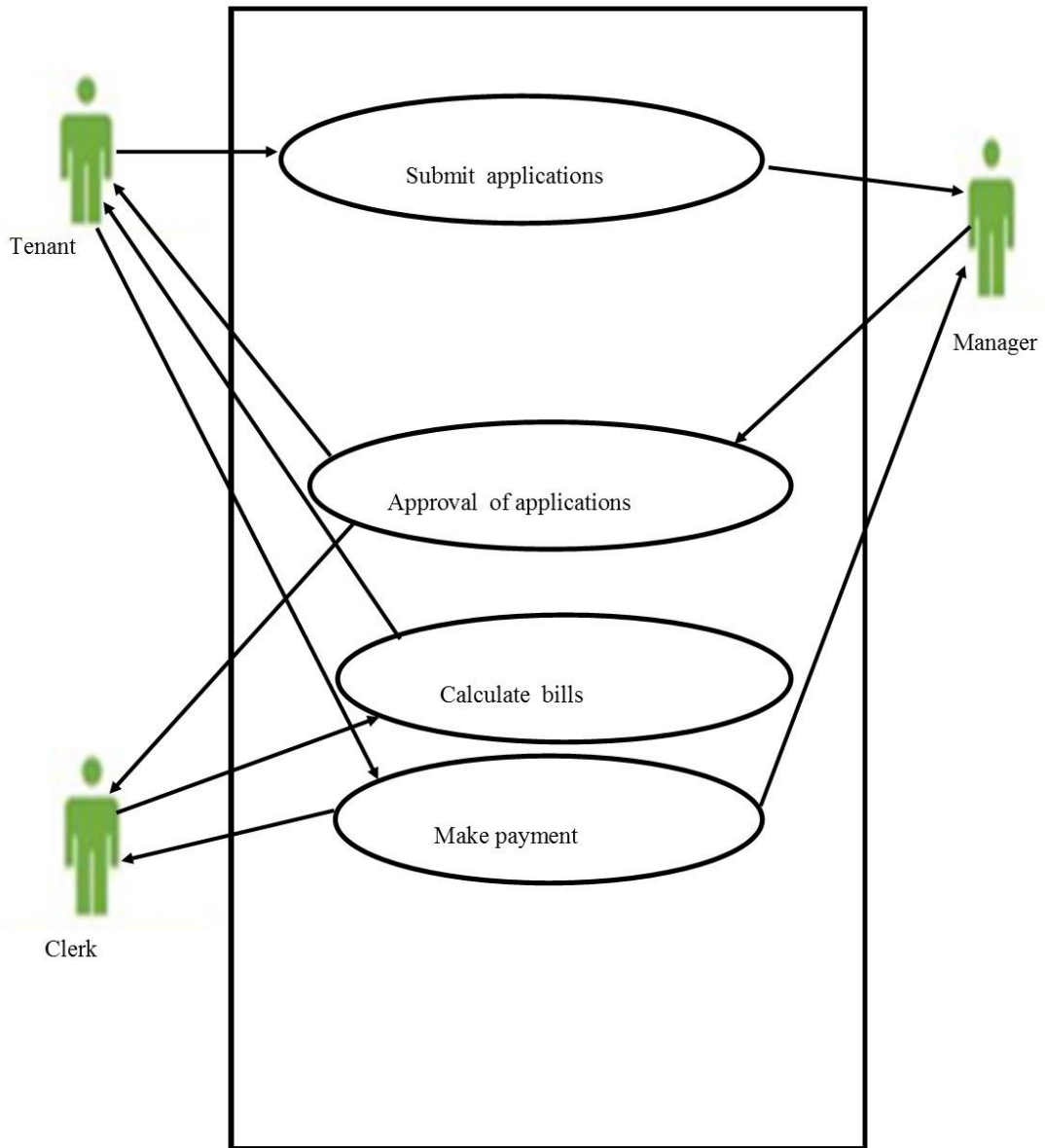
3.8.1 Functional requirements

Sommerville (2012) stated that functional requirements is a state that shows the behavior of the system in order to meet the needs of the users. All the tasks that will be done by the new system are regarded as functional requirements. The way in which the system will respond to inputted data and then process it to give meaningful output is also considered as functional requirement. The functional requirements of the system are as follows:

- ❖ The system calculates the monthly bills for the tenants and send the bills to the tenants' accounts. This allows easy communication with the tenants as well as the elimination of human errors during the billing process.
- ❖ The system is also capable of generating reports that will be used for management purposes. It produces summerised information that is useful in decision making.
- ❖ The system is capable to advertise the available rental space online.
- ❖ The system allows the registration of tenants and then send their login credentials via the email.
- ❖ Allow tenants to upload the proof of payments online after they make their payments through the bank.
- ❖ The system allows the manager to approve or disapprove the applications online. This allows fast approval of applications as well as reducing the risks of applications being misplaced.

3.8.1.1 Use case diagram

The use case diagram is a model that describes how the users interact with the system (Sommerville, 2012). They are used by the analyst for gathering the system requirements. They provide an outside view of the system as well as identifying the external and internal factors influencing the system. The responsibilities of the new system will be derived from the use case diagram. Use cases are prepared to assist the analyst to analyse the system in order to understand its functionality.



Key

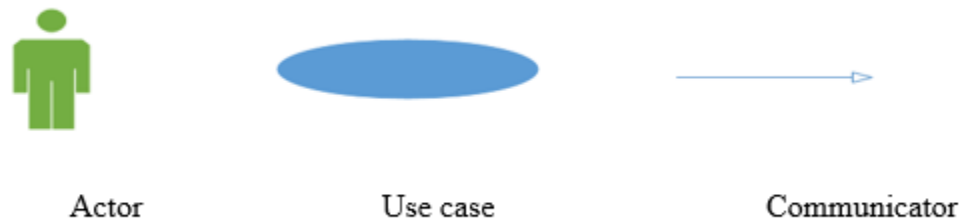


Fig 3.4 Use case diagram

3.8.2 Non-functional requirements

According to Rosa et al (2000), non-functional requirements of the system is where by we forecasts on the system quality. They give a description of some of the extended features of the system and its performance in general. Non- functional requirements are the properties of the system (Rosa et al, 2000). Non- functional requirements include:

- ❖ Maintainability – the system is easier to maintain because of the availability of the documentation.
- ❖ Security – the system is secured through the use of passwords.
- ❖ The system is able to generate reports.

3.9 Conclusion

In the wake of having an in-depth analysis of the current system by using various data gathering methodologies the analyst came up with well informed decisions. The analyst had a clear understanding of the system processes, functional and non-functional requirements. After weighing all the available alternatives, it was proven that in-house development is the best option and the analyst must proceed to the design phase. The end of this chapter marks the commencement of the design phase.

Chapter 4: Design Phase

4.1 Introduction

This is a phase that focused on how the new system operate. It gives a clear picture of how the new system functions in terms of software, hardware and the network structure. This stage is comprised of various activities such as physical design, architectural, logical, and interface design as well as process analysis. These processes act as guiding tools during system development so as to help the developer to deliver the system that is anticipated to meet user requirements. This is a stage in which the developer come up with the system that meet the user needs.

4.2 System design

According to Godfrey (1999), system design is a process of describing all the system components such as architecture and interfaces. This is a phase that is concerned with the implementation of system objectives as well as highlighting how the system will be developed (Oz, 2008). According to Mall (2004), this phase is comprised of various components such as processing elements and overall entity communication. Below are a set of characteristics that were anticipated from the new system:

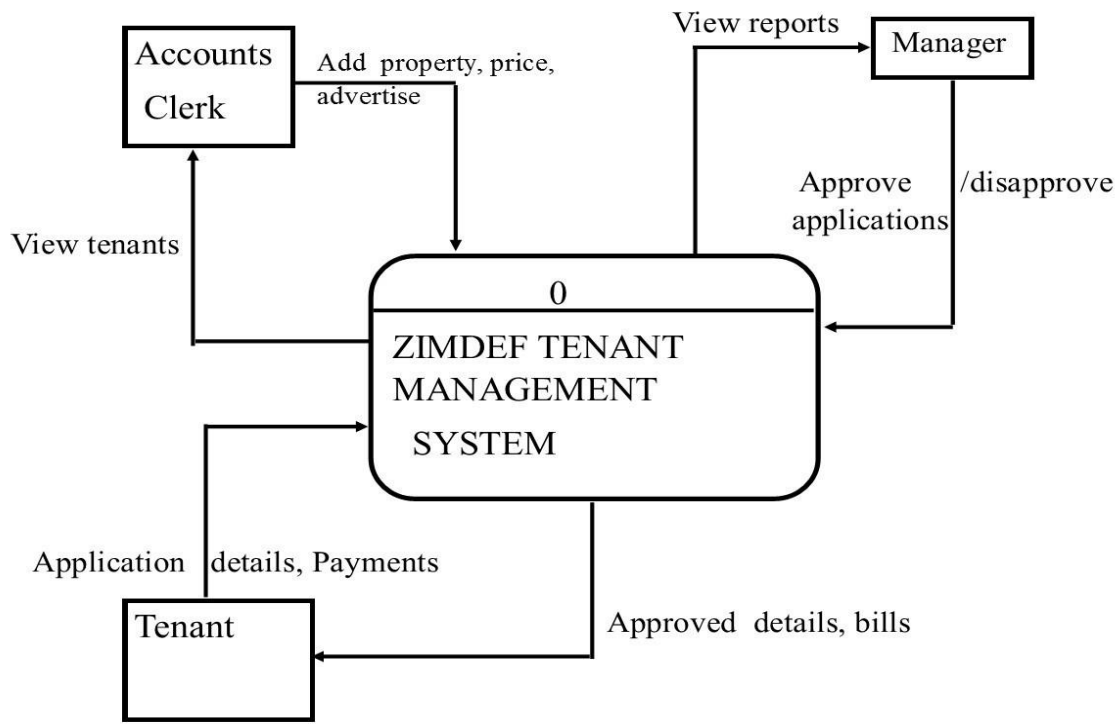
- ❖ **Security**- the new system was expected to have tight security to prevent unauthorized access to the system's data as well as dealing with recovery in the event of failure.
- ❖ **Efficiency**- to ensure that the approval of tenants' applications were made easier and simple as well as easy calculation of bills.
- ❖ **Friendliness** – the new system was developed in such a way that the users will find it easy to use.
- ❖ **Reliability** – the system should be made available for users to use at any time they want to, therefore the users must have confidence in the system.
- ❖ **Maintainability** – due to changing technology the system is able to accommodate new features and functions so that it won't be rendered obsolete.

How the system works

ZIMDEF Tenant Management System will be an easy, effective and efficient way of managing the company's properties. This system will enable the clerk to advertise the available properties to potential tenants online. The potential tenants will then apply for rental space online. The manager will then approve or reject the application. Once the application is approved the tenant is automatically registered in the system. The system informs the tenant via email that the application was successful and the credentials that the tenant must use to access the system are also attached on the email. They are then advised to pay rent through the ZIMDEF bank account before they occupy the space. After the payment is done, the tenant must upload the proof of payment on the system and the clerk approves them. At the end of the month the system calculates the tenant bill and send an invoice to the tenant account as well as via email. After every payment made by the tenants through the bank, they must upload the proof of payments on the system so that the clerk approves them. After the approval, the system notifies the tenants that their payments were approved. The system informs the clerk and the manager about the number of tenants they have. The system also shows the graph representing the square meters occupied by the tenants and the available space that need to be occupied. The system generates reports for management use.

4.2.1 Context diagram of the proposed system.

The context diagram is defined as a simplified diagrammatical representation which illustrates how data flows throughout the system (Stephens, 2015). In addition, Sommerville (2012) explained that it is a diagram that shows the system boundaries, system entities as well as showing how these entities will interact and communicate with each other in the system. Hence, the context diagram help the developer to identify the major information as well as data flow amongst the entities of the system.



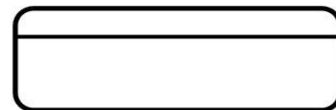
KEY



Entity



Data flow

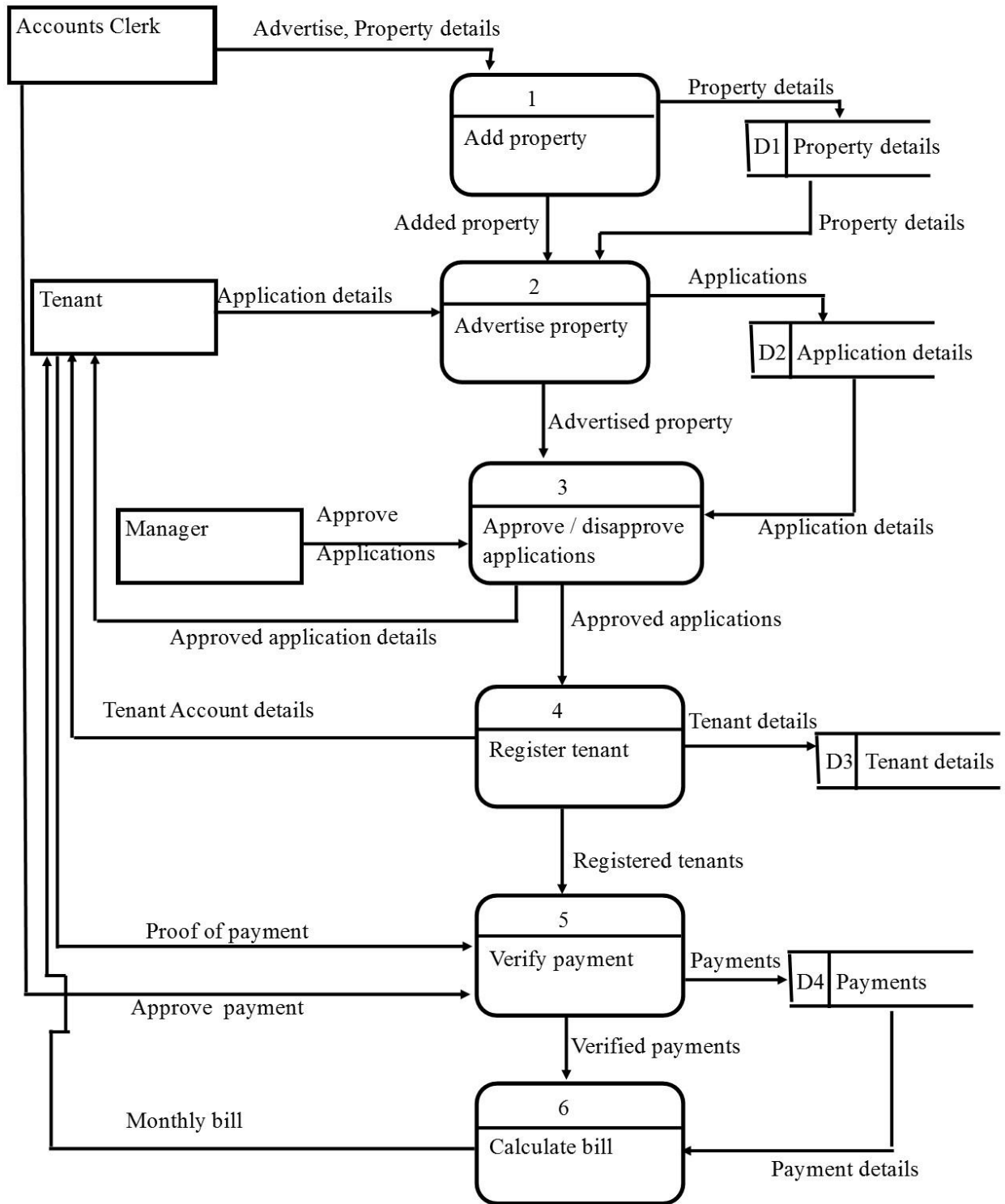


System

Fig 4.1 Context diagram

4.2.2 Data flow diagram of the proposed system.

The data flow diagram is abbreviated as DFD and is a structured analysis diagram that show the input, output as well as the data storage of the system (Satzinger et al, 2012). Dennis (2012), added that the DFD is drawn to illustrate how the processes of the proposed system work in order to accomplish their expected tasks. In general the DFD is used in the preliminary stages to give an overview of the system as a whole. The DFD consist of the following components entities, processes, data flows and data stores.







Key	
	Entity
	Data flow direction
	Data storage
	Process

Fig 4.2 Data flow diagram of the proposed system

4.3 Architectural design

Architectural design defines the software, hardware as well as networking environment of the proposed system (Pratt, 2014). It gives the developer an understanding of the required hardware and software to run the system. Somerville (2004) explained that architectural design gives the description of the technical platform that is required for the new system to run. The major goals of architectural design is to minimize the bottlenecks caused by the architectural factors, hardware and software. The architectural design of the system help the analyst to come up with the system initial forms. Roberts (2001) concluded that this design defines the relationship amongst the hardware and the components of the system.

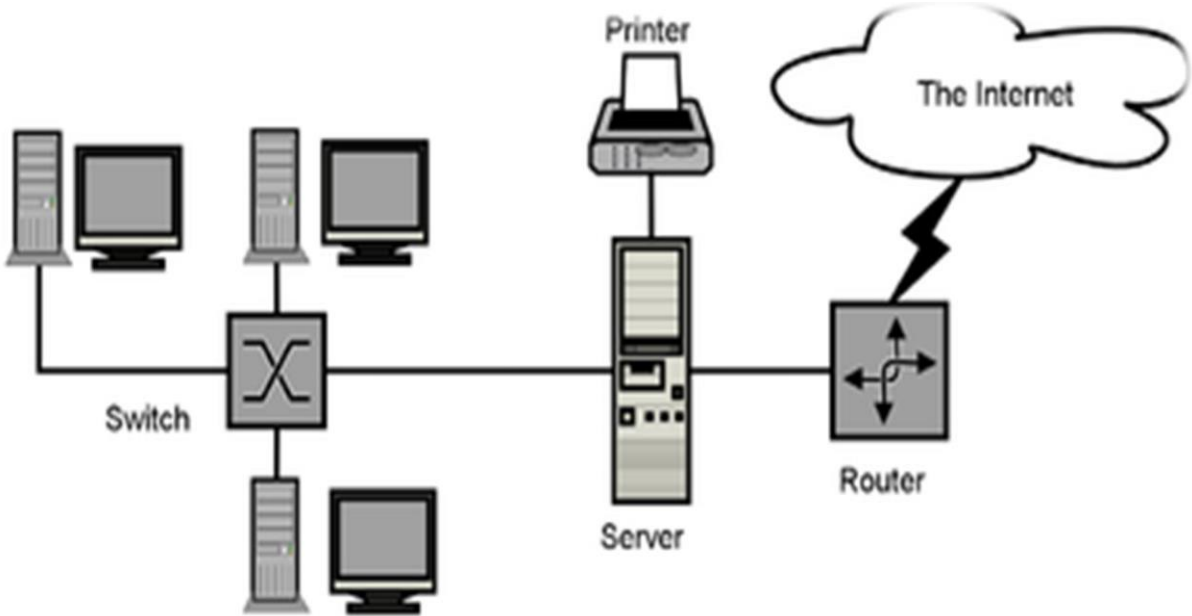


Fig 4.3 System architecture design

4.4 Physical design

According to Sommerville (2008), physical design is a stage in which the system is transformed from the logical design into the physical design. This stage enlightens how the new system is going to be created. According to Eppingner (2008), the physical design expands to a series of components which includes the system components, the system interfaces and the hardware. In addition, physical design is a phase where logical design is translated into operational design.

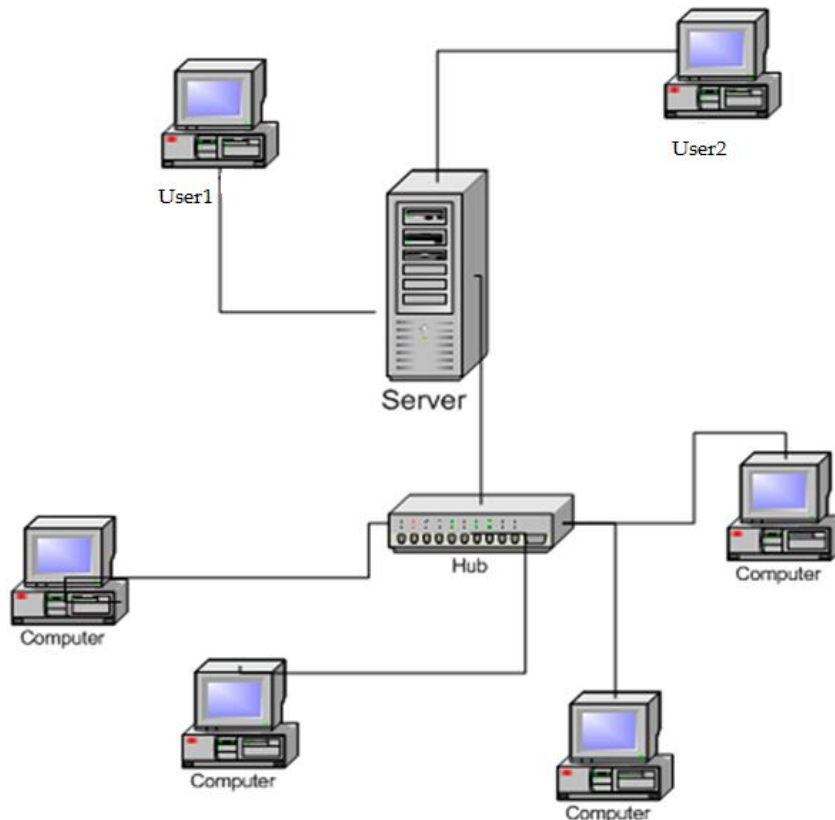
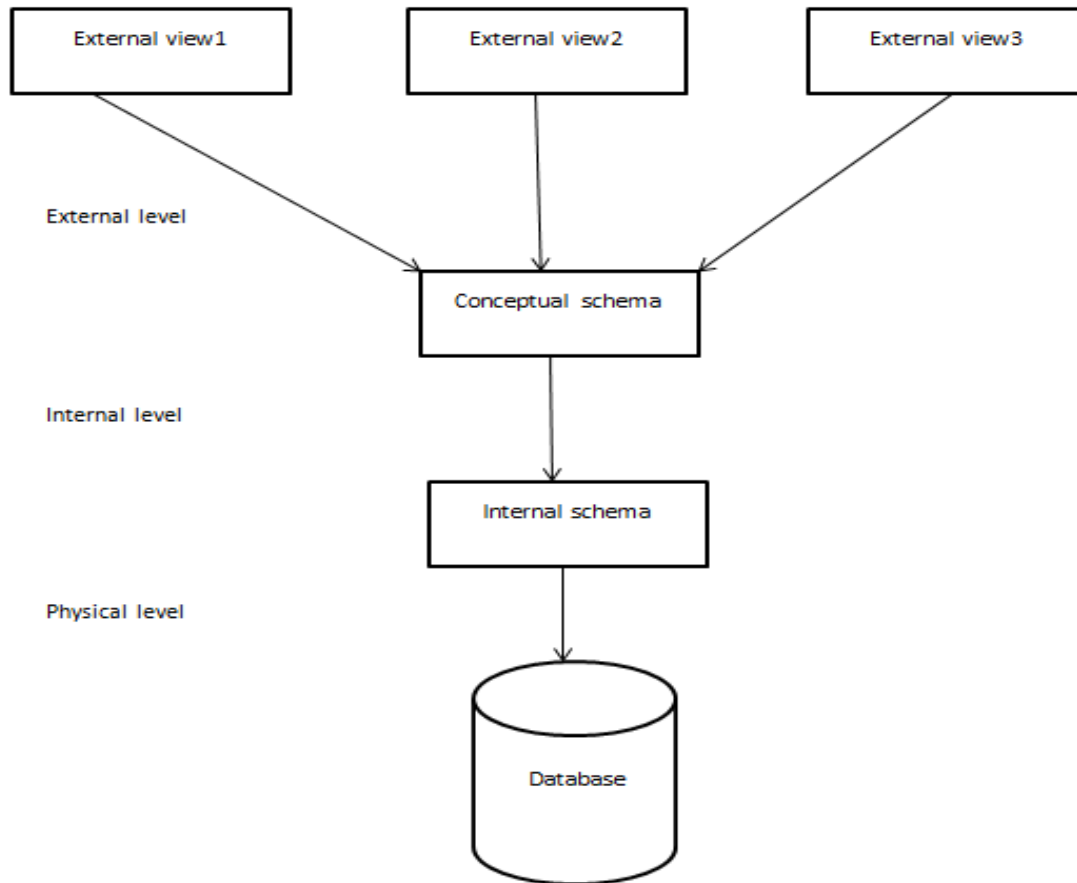


Fig 4.4 Client server

4.5 Database design

According to Rosenblatt (2013), database design describe and define the logical and physical structure of the database which enables rapid responses as well as easy of access in order to satisfy the diverse needs of the users. This is a stage where the system data structures are



designed and the manner in which they are represented in the database. Data integrity, data security and data consistency are the characteristics of a well-designed database. ANSI SPARC architecture is going to be used during the system development in order for users to have a clear picture of the database.

Fig 4.5 Database design architecture

4.5.1 Database tables

The database tables are a combination of rows and columns. Below is a list of database tables that are found in ZIMDEF Tenant Management System.

Table 4.1 Tenant table

Field	Data type	Description
Full name	Varchar	Tenant full name
National ID	Varchar	Tenant national Identification number
BP Number	Varchar	Tenant Business Partner number
Phone	Varchar	Tenant phone number
Email address	Varchar	Tenant email address
Username	Varchar	Tenant username
Password	Varchar	Tenant password

Table 4.2 Clerk table

Field	Data type	Description
Full name	Varchar	Clerk full name
Username	Varchar	Clerk username
Password	Varchar	Clerk password
Phone number	Varchar	Clerk number
Email address	Varchar	Clerk email address

Table 4.3 Manager table

Field	Data type	Description
Full name	Varchar	Manager full name
Username	Varchar	Manager username
Password	Varchar	Manager password

Phone number	Varchar	Manager number
Email address	Varchar	Manager email address

Table 4.4 Payment table

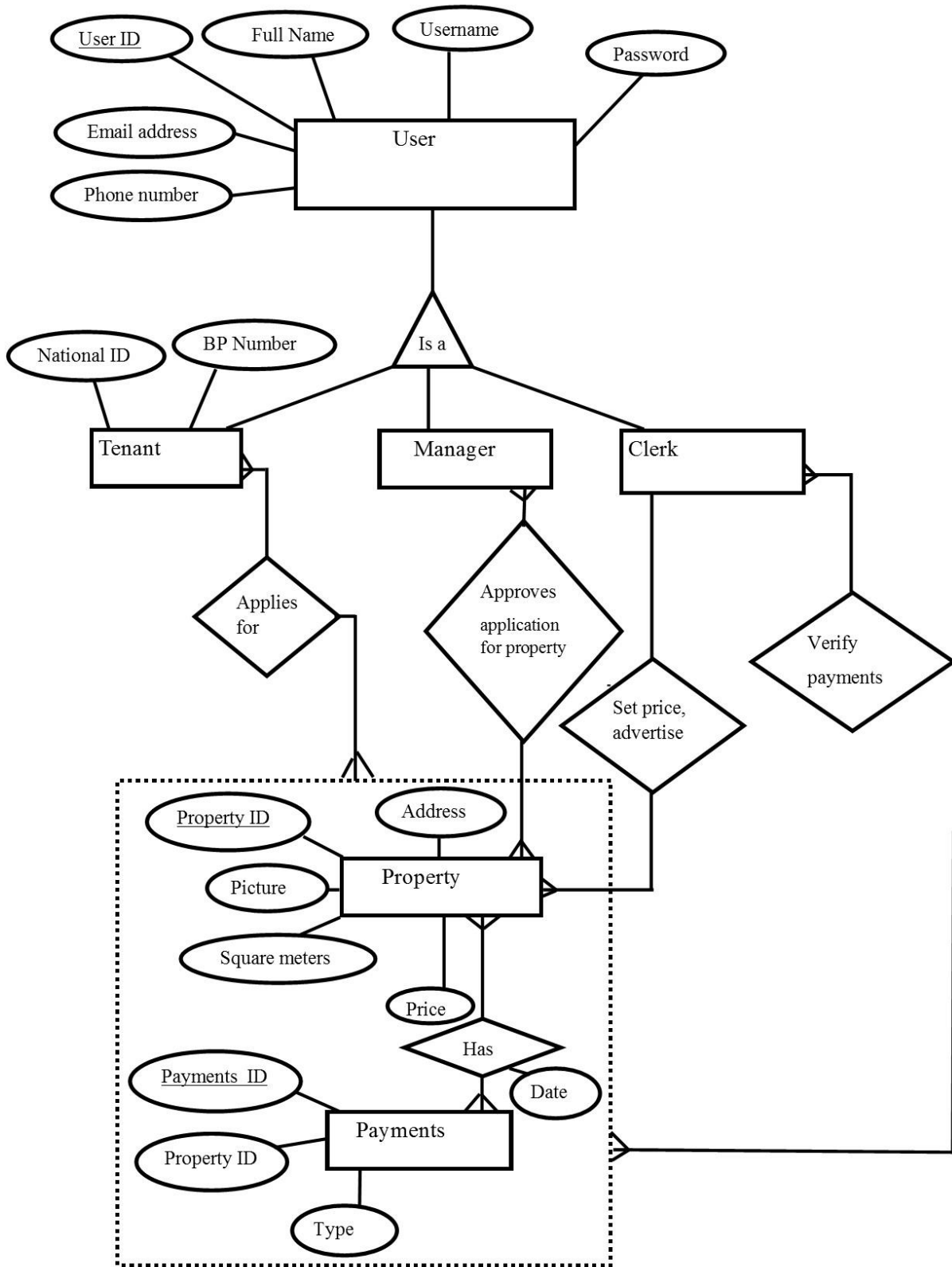
Field	Data type	Description
Property ID	Varchar	Property Identification number
Date	Date	Payment date
Type	Varchar	Type of payment

Table 4.5 Property table

Field	Data type	Description
Property Address	Varchar	Property Identification number
Picture	Varchar	Property picture
Price	Currency	Price of property
Square meters	Varchar	Property square meters
Date	Date	Date

4.5.2 Entity-relationship diagram

An entity relationship diagram is abbreviated as ERD and is defined as a graphical representation that is intended to show the relationship between objects, people and events within an information system (Joanne, 2006). Furthermore it has been defined as a data modelling technique that a developer can use to define an organisation processes which he can use as a foundation or basis for a relational database. According to Hazra (2013) an ERD has 3 main components which are entities, objects which have data stored about them and also cardinality which define the relationship between entities in terms of numbers. Fig 4.6 to follow shows the ERD of the proposed system.



KEY

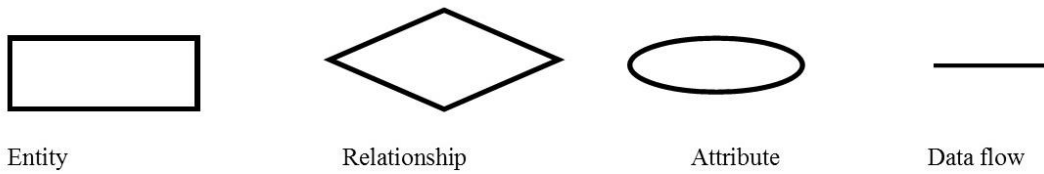
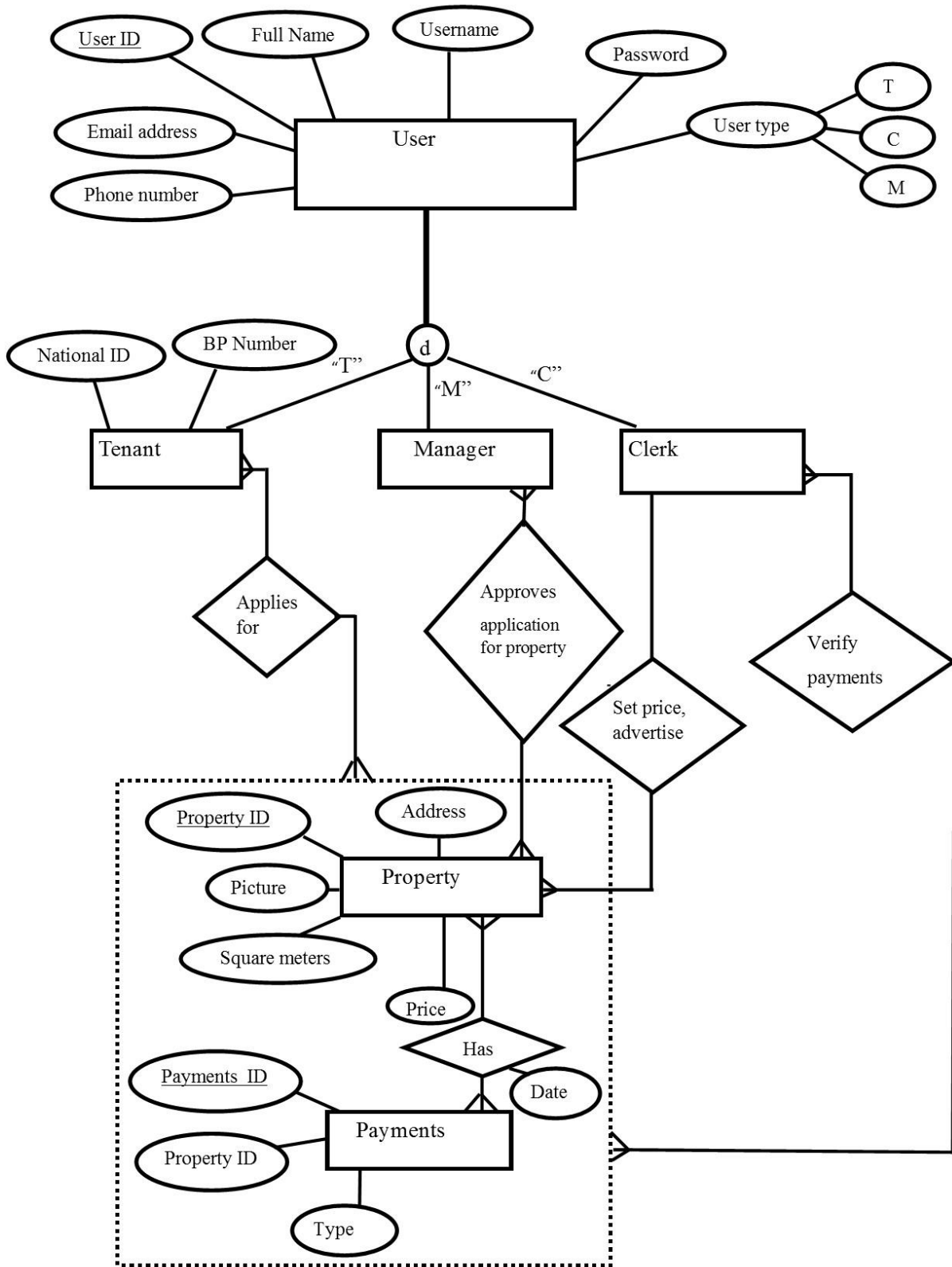


Fig 4.6 Entity relationship diagram

4.5.3 Enhanced entity relationship diagram

Enhanced entity relationship diagram (EERD) is also known as the extended entity relationship diagram. According to Cornell and Crocket (2008), EERD is an abstract model which defines the data specification diagrammatically presenting super types, subtypes and the participation constraints that are involved. The main aim of using EERD is to illustrate the complex relationships among objects in a relational database. EERD evolved from the ERD with new concepts being added (Dennis, 2012). Below is an EERD of the new system.



KEY



Entity



Relationship



Attribute



Data flow

Fig 4.7 Enhanced entity relationship diagram

4.6 Program design

According to Clements and Kazman (2012), program design is a process of defining some programs that are supposed to be written and the manner in which they are to be written. It also involves explaining how different pieces of code are to be combined in order to come up with a complete module or program. This is a stage where technical requirements are logically presented for easy writing of the code. This phase is of paramount importance during system development in the sense that it ensures that the developer get a clear understanding of the code, organize and integrate it (Stephens, 2015). The developer made use of sequence and class diagrams to illustrate the system design.

4.6.1 Package diagram

Unified Modelling Language (UML) is a language that the developer used in order to come up with the package diagram. The package diagram is vital in describing the communication of the software components that are in classes to form packages. These components are obtained after the large system is broken down into smaller components. In addition, Duffy (2011) explained that package diagram is a collection of software components connected in a logical way.

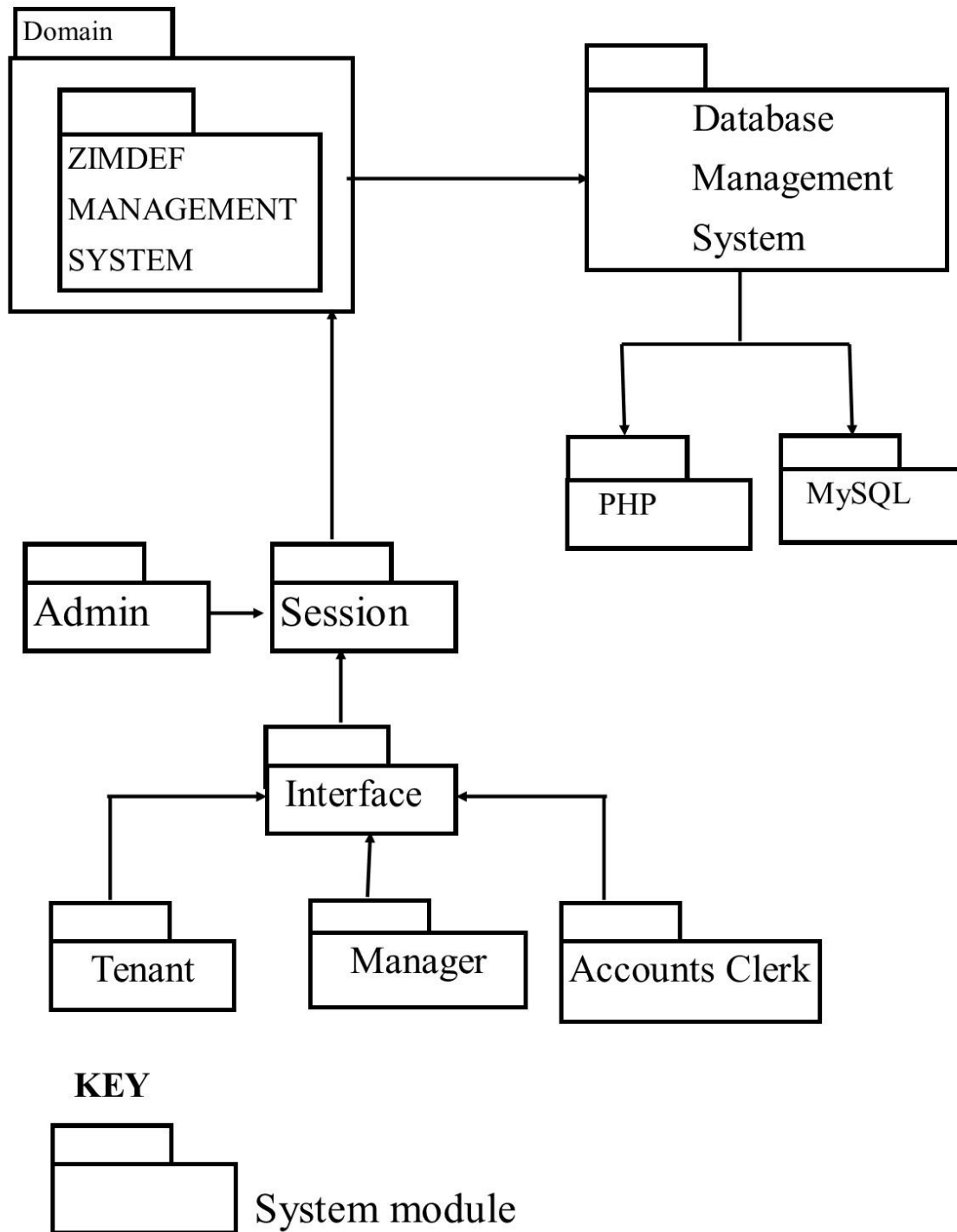
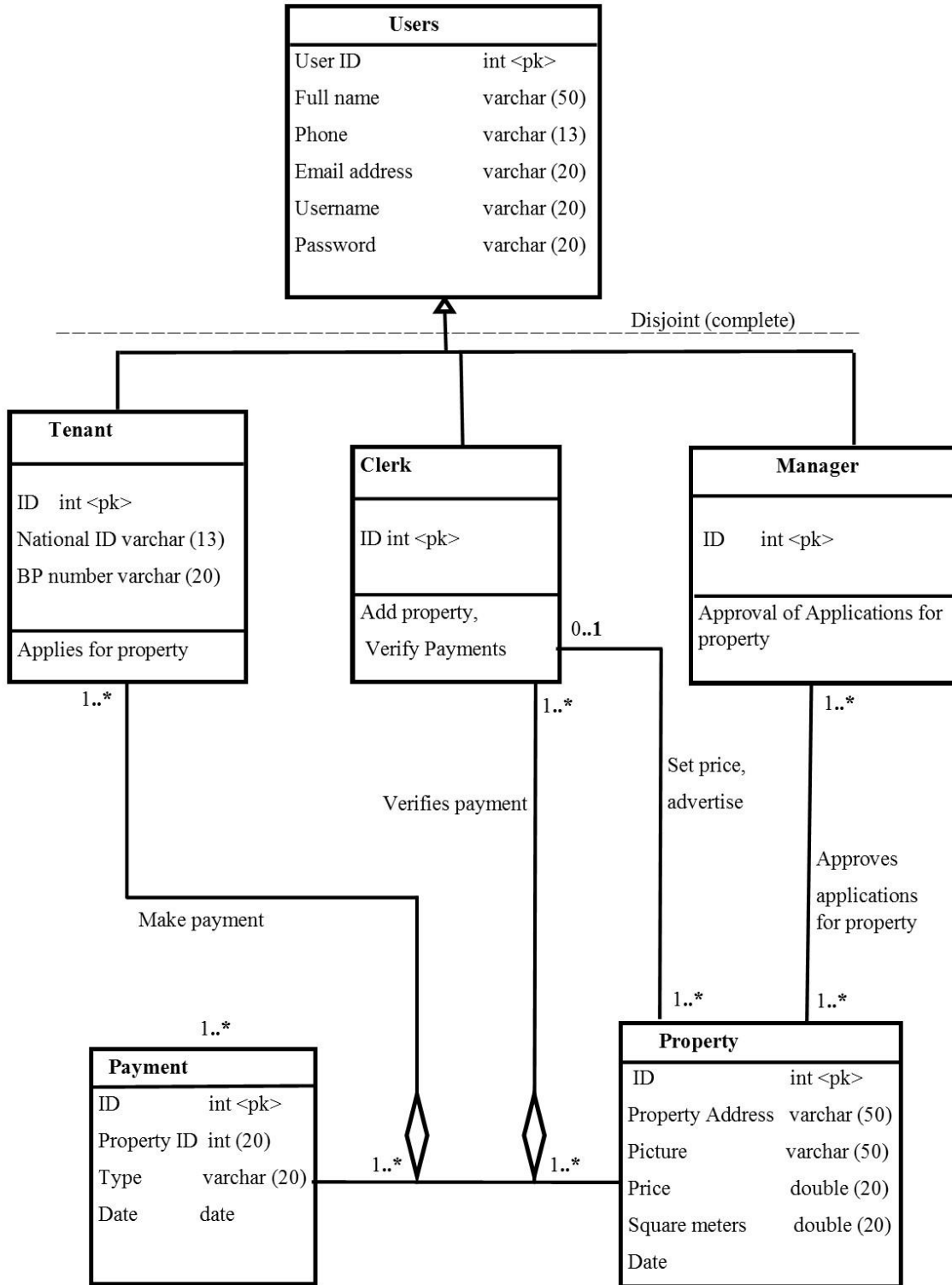


Fig 4.8 Package diagram

4.6.2 Class diagrams

Sommerville (2012) defined class diagrams as diagrams that outline stationary data structures and describe the actions executed on that data. These diagrams clearly express the object oriented model as well as the associations that are participated within the internal structure. Class diagrams can also be defined as the static vision of a developing system Ibid.



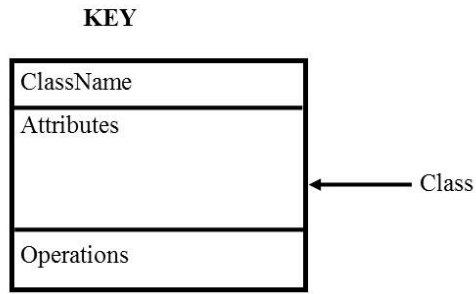
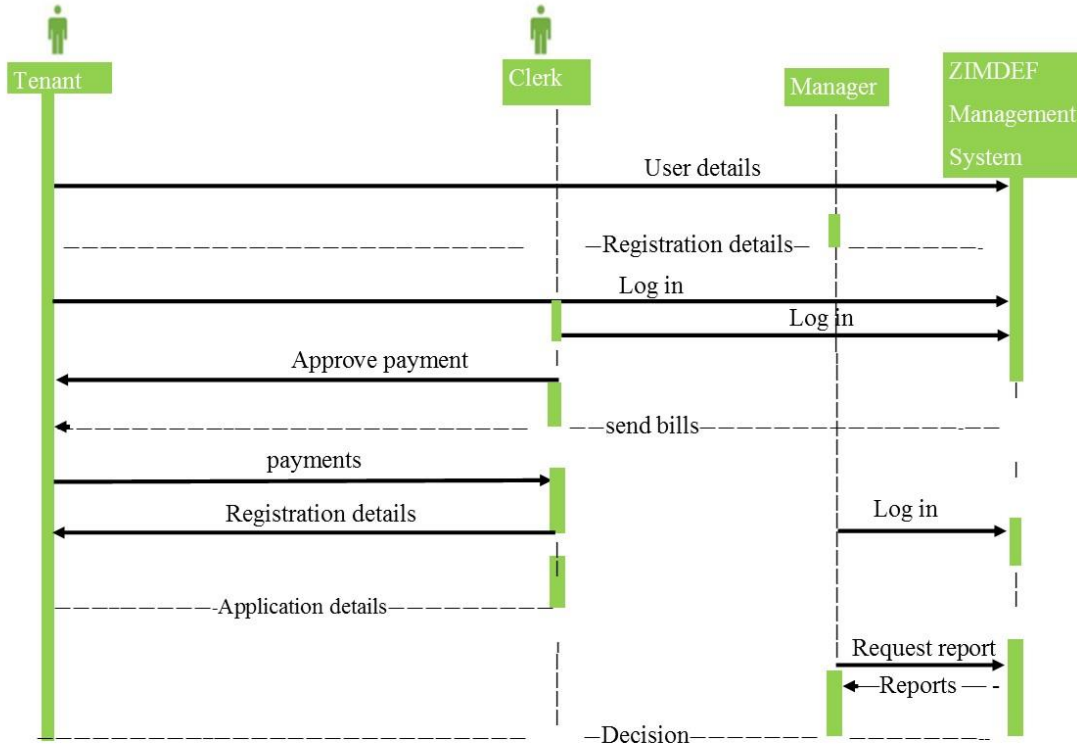


Fig 4.9 Class diagram

4.6.3 Sequence diagram

Dennis and Ruth (2012) defined sequence diagram as an interaction diagram which illustrate how the objects work with one another. Sequence diagram shows the interaction of objects arranged in time sequence. In addition, it is defined as the dynamic representation of the proposed system precisely presenting all the information across objects thus according to (Pratt, 2004).



KEY

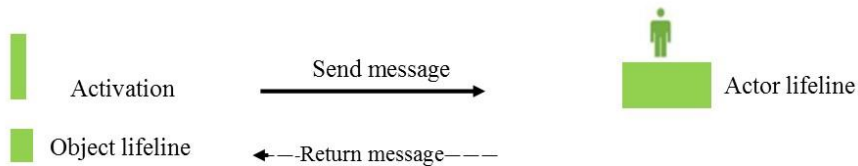


Fig 4.10 Sequence diagram

4.7 Interface design

According to Whitten (2003), interface design is a platform that facilitate communication or interaction between the system and the users. System interfaces must be designed in such a manner that accommodate all the users. These interfaces must be user friendly, informative and easy to use. The manner in which the interfaces were designed allow the system users to input data into the system and get desired output with minimum efforts required.

4.7.1 Menu design

The system menu is a platform that shows the information pertaining the organization, advertisements as well as the login button.

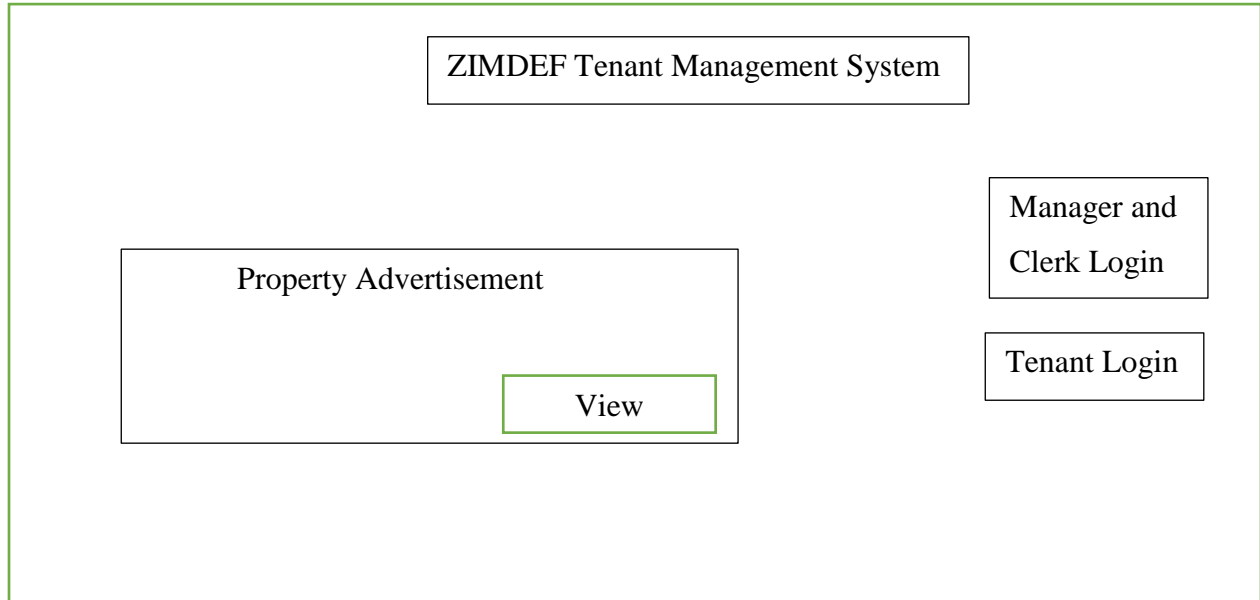


Fig 4.11 Home page

4.7.1.1 Main menus

The main menus allow the user to execute various actions on the system. In relation to ZIMDEF Tenant Management System, the main menus enable the approval of the applications by the user. These main menus allows the user to view the system major controls. The manager main menu has various platforms to allow the manager to approve or disapprove applications, view tenants, transactions as well as reports.

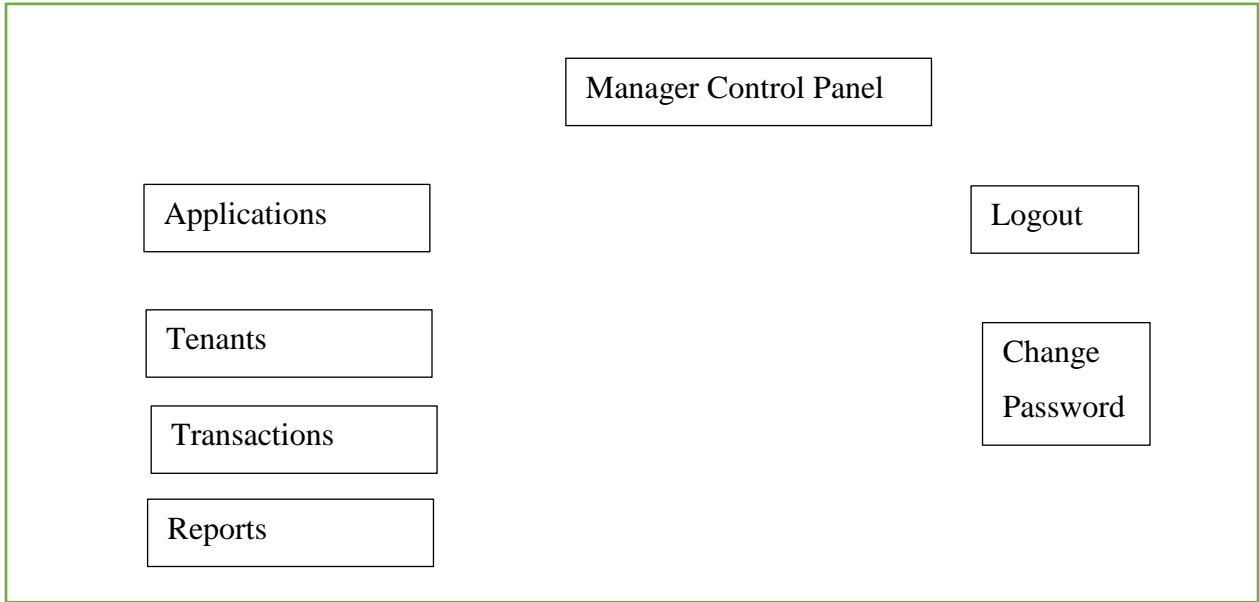


Fig 4.12 Manager main menu

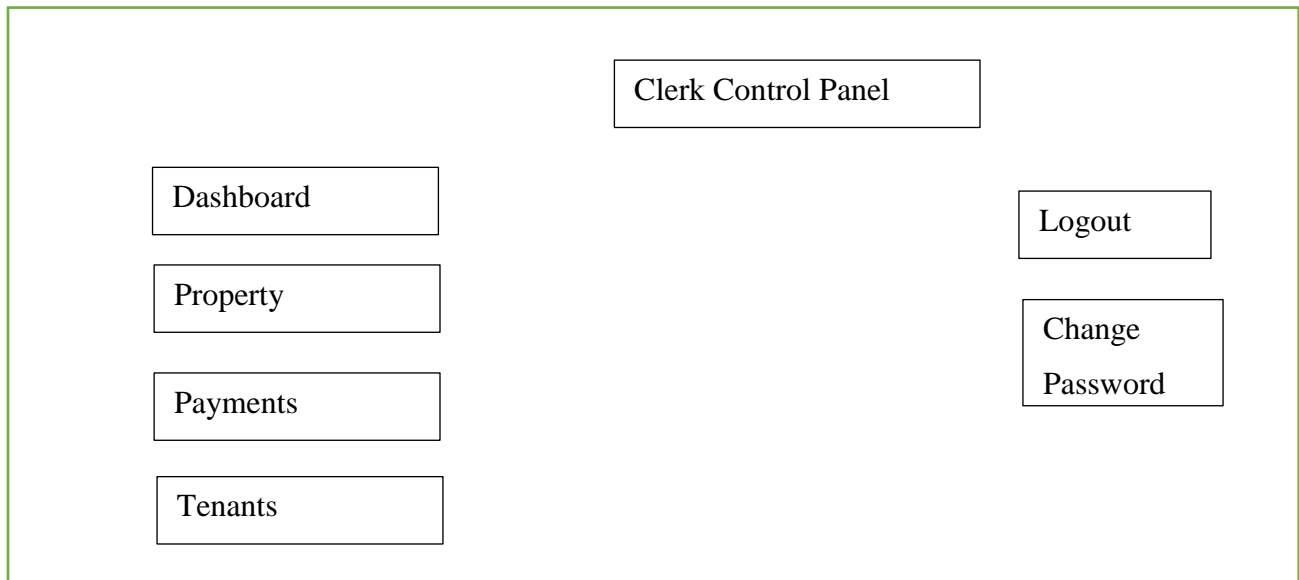


Fig 4.13 Clerk main menu

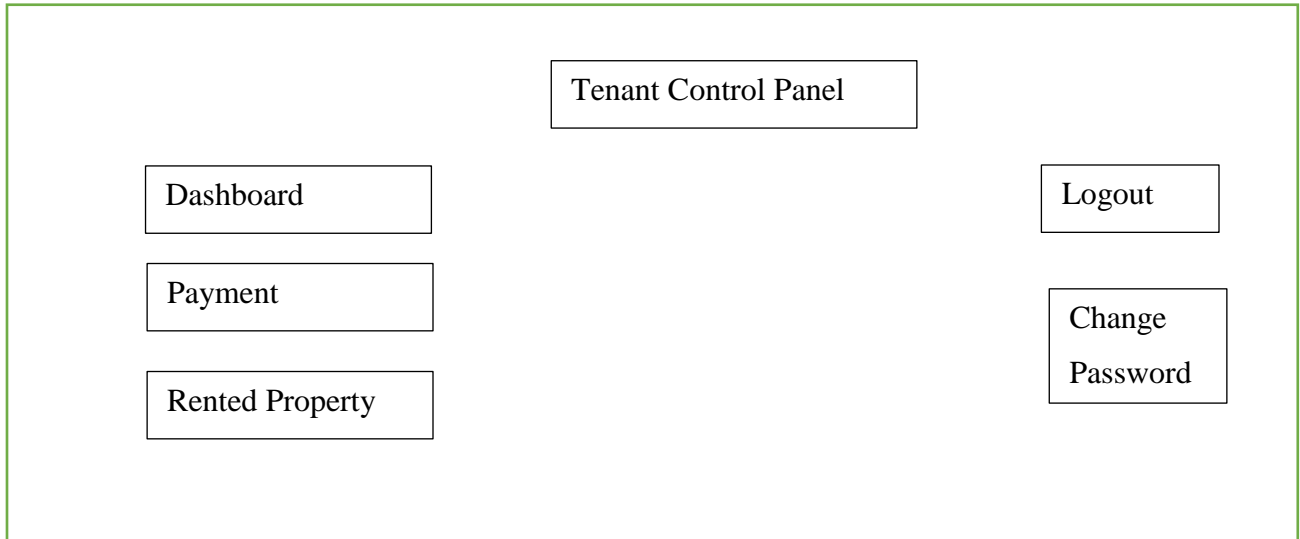


Fig 4.14 Tenant main menu

4.7.1.2 Sub-menus

The submenus of the system allow the user to navigate to other functions in order to perform a specific task. They allow the user to perform a unique action that brings the final results. In reference to ZIMDEF tenant management system the submenus allow the user to view the accepted, rejected and pending payments. The submenus also allow the users to view the property rented.



Fig 4.15 Accepted payments sub-menu

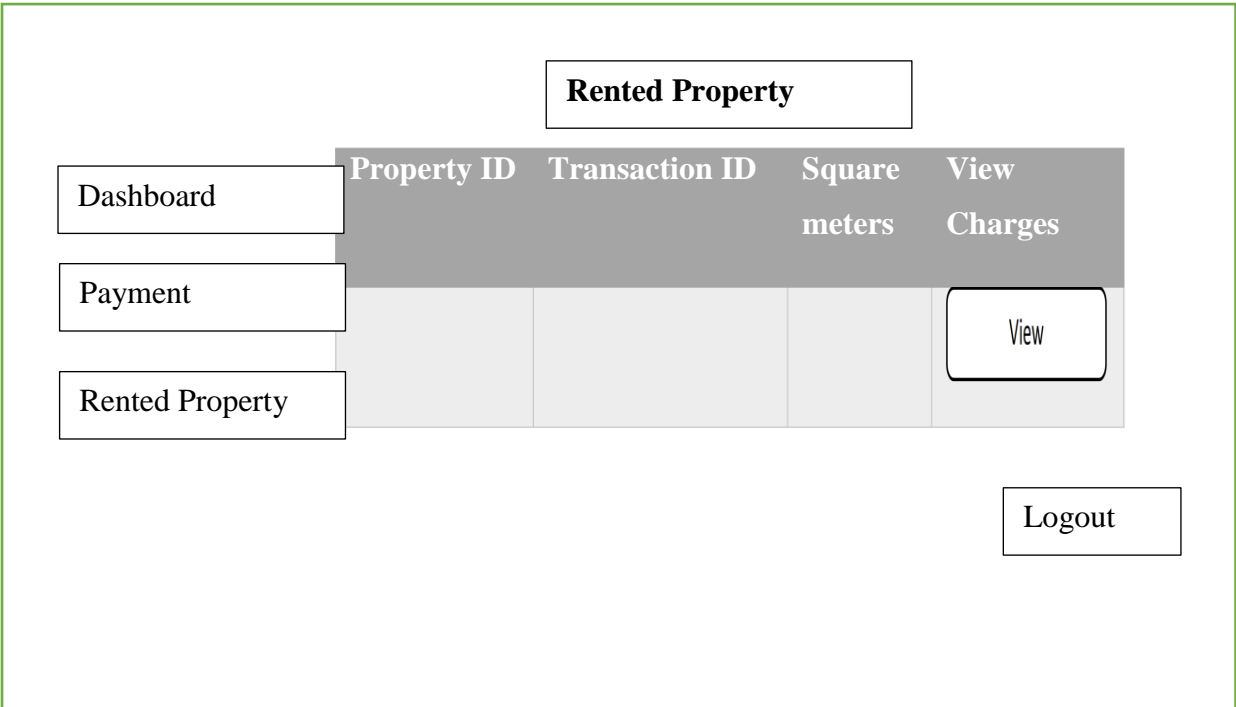
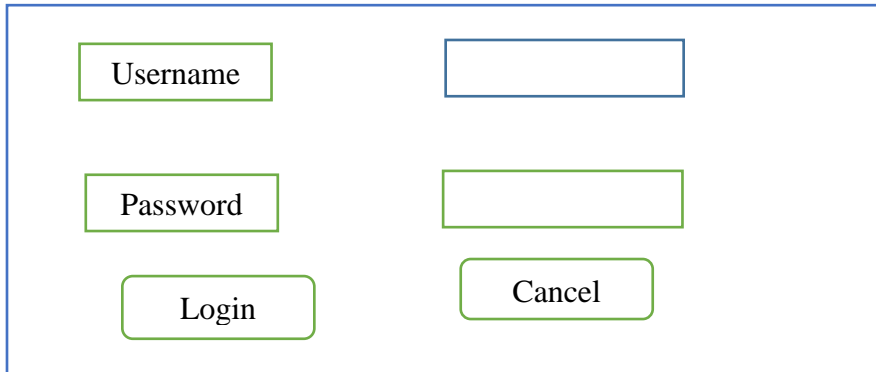


Fig 4.16 Rented property sub-menu

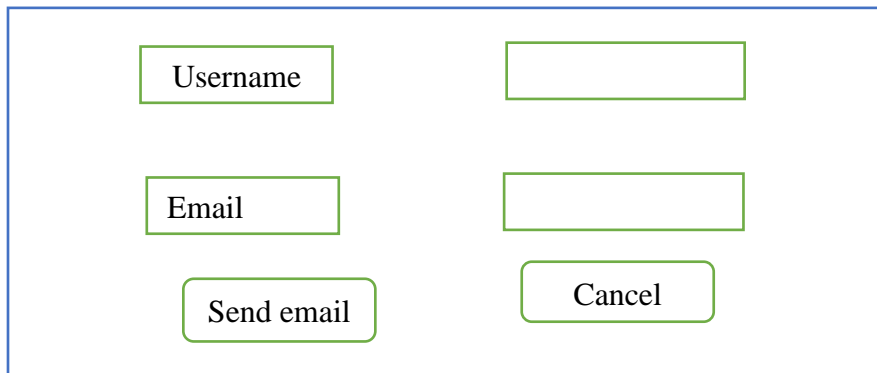
4.7.2 Input design

According to Shelly and Rosenblatt (2012), input design enable the users to feed data into the system through the use of system forms. The vital aspect of input design is allowing data capturing into the system and the inputted data is transformed into the format that is understood by the machine. Below are the system input forms.



A diagram of a login page form enclosed in a blue border. It features three rows of elements. The first row contains a label 'Username' in a green-bordered box followed by an empty white input field with a blue border. The second row contains a label 'Password' in a green-bordered box followed by an empty white input field with a green border. The third row contains two buttons: 'Login' on the left and 'Cancel' on the right, both in green-bordered boxes with rounded corners.

Fig 4.17 Login page



A diagram of a recover password form enclosed in a blue border. It features three rows of elements. The first row contains a label 'Username' in a green-bordered box followed by an empty white input field with a green border. The second row contains a label 'Email' in a green-bordered box followed by an empty white input field with a green border. The third row contains two buttons: 'Send email' on the left and 'Cancel' on the right, both in green-bordered boxes with rounded corners.

Fig 4.18 Recover password

REGISTER PROPERTY

Property Address	
Property rooms	
Property Description	
Property t Image	Choose file

Register

Fig 4.19 Register property

ZIMDEF House for Tenants to Rent

Date registered	2017-03-04
Number of rooms	2
Description	20m2 each
Physical Address	102 Fort Street,
Date to move in	2017-04-01
Enter Rental Amount	

Update

Fig 4.20 Add rental amount

In order to avoid useless applications please enter your email and get a code to apply

Enter Email

Fig 4.21 Get code

Accepted and rejected applications will be notified via email

Enter application code

Enter phone

Enter email

House ID

Date to move in

Upload Document

Fig 4.22 Property application form

Upload proof of payment for rent

Property number

Enter Amount

Choose file

Fig 4.23 Tenant upload proof of payment

4.7.3 Output design

According to Duffy (2011), output design help to facilitate the communication between the user and the system. It provides the feedback to the user when a certain query has been made. The new system produce the reports for the tenants that have paid their bills and those with arears.

View Tenants Payments			
Tenant Name	Rent ID	Payment Date	Amount

The figs below show the system output design.

Fig 4.24 Tenant payments

View Accepted Applications		
Applicant Name	Phone	Email

--	--	--

Fig 4.25 Accepted applications

View Rejected Applications		
Applicant Name	Phone	Email

Fig 4.26 Rejected applicants

Tenant Bills			
Tenant Name	Arrears	Current Balance	Total Amount

Fig 4.27 Tenant bills

View property			
Property ID	Price per square meter	Tenant Name	Square meters occupied

Fig 4.28 View property

View Tenants						
Tenant ID	Tenant name	Months lived	Square meters occupied	Arrears	Current Balance	Total Amount Owing

Fig 4.29 View tenants

4.8 Pseudo code

Pseudo code is a piece of program that explain the system operations thus according (Stellman and Greene, 2006). Kendall and Kendall (2005) added that pseudo code gives a clear understanding of the system operations as it describes the system's input, processes and output.

Login module

Enter username and password

If username and password is correct

Then direct user to main menu

Else display invalid username or password

End if

End

Property registration module

Enter property address, number of rooms and description

If details are valid

Then upload property image

Else display invalid details.

End if

End

Property advertising module

Get details from property registration

Enter rental amount

If rental amount is valid

Then advertise

Else display appropriate message

End if

End

Get registration code

Enter email address

If email address is valid

Send registration code to email

Else display invalid email address

End if

End

Application approval module

View applications

If applicant meet the required requirements

Accept application

Else reject application

End if

End

Tenant registration

Get tenant details from application module

If approved

Then register tenant

Else do not register

End if

End

4.9 Security design

According to Hughes and Cottrell (2009), security design is a procedure that ensures system integrity, reliability as well as protecting the system from intruders. System security is one of the key aspects during the system development therefore it calls for the developer to pay special attention. The developer must design the policies and procedures that govern the system use in terms of the logical and physical security.

4.9.1 Physical security

Physical security is a process that ensures a safe working environment that is designed to curb access to the system from unauthorised users (Forouzan, 2007). The use of locks is a physical security that ZIMDEF put in place to ensure security of the company offices. Those without the keys there will be no access the offices hence promoting security. ZIMDEF also employed security guards to monitor that no unauthorised person takes the hardware and the software out of the company premises.

4.9.2 Network security

Network security is a procedure to safeguard the exchange of data among various devices or gadgets connected together (Shelly and Rosenblatt, 2012). Network security is of paramount importance during system development as it promotes integrity, confidentiality, privacy as well as entity authentication as this instills confidence to users of the system since they know that their

data is secure. Servers will be used to monitor the system and other network resources. As a way of ensuring tight security only authorized users will gain access to the servers through the use of unique usernames and passwords. Firewall will also be used as a security measure since it will be used to monitor as well as controlling the outgoing and incoming network traffic based on the predetermined rules. The passwords will expire after every two months and the users are prompted to change them.

4.9.3 Operational security

According to Kendall and Kendall (2005), operational security is referred to as the non-existence of security related failures during the life of the system. At this stage the developer is concerned with the system weaknesses that maybe experienced during the operating life of the new system. The analyst must therefore address these security issues that are likely to be encountered during the operational life of the system. Tackling these issues help to minimize the risk of hindering the operations of the system hence improving the performance of the system. All users will have unique usernames and passwords so as to prevent unauthorized users to access the system. These passwords will expire after every two months and the users are prompted to change them.

4.10 Conclusion

The developer succeeded to translate the requirements of the users into logical design of the system. The analyst made use of process flow diagrams and UML in order to explain how the system will operate. After discussing the interface, architectural, and physical design of the new system, the developer will then discuss the installation, implementation and maintenance in the chapter to follow.

Chapter 5: Implementation Phase

5.1 Introduction

This is the final phase of system development whereby the new system is deployed into a real world environment (Eppingner, 2008). At this stage the new system is tried and tested to ensure that it performs according to the user requirements and well as eliminating the problems that were identified in previous phases. Ibid stated that the new system is tested to in order to identify bugs within the system so that corrections are made prior the installation of the system. The system developer at this point writes the code, test it as well as performing validation and verification so that the system objectives are met ibid. The developer in this phase will perform various tasks such as coding, testing, implementation, training and maintenance.

5.2 Coding

Coding is a section of programming scripts, declaration and statements in coding language that produce a program source code (Whiteman and Mattord (2009). HTML, Bootstrap, Java script and PHP were the tools that were used during the development of ZIMDEF Tenant Management System.

5.3 Testing

System testing refers to the procedures and actions that are performed by the programmer in order to check if the new system performs as anticipated by the system users and analysts (Pressman, 2015). In addition, Unhelkar (2005) highlighted that it is of paramount importance for the system to be tested to check whether the user requirements are met before deploying the system on a large scale of a real world environment. System testing is carried out using

simulated data. According to Sommerville (2012), system testing helps the developer to take note of various system anomalies, non-functional system attributes as well as test run errors. The developer carried out the testing using five techniques.

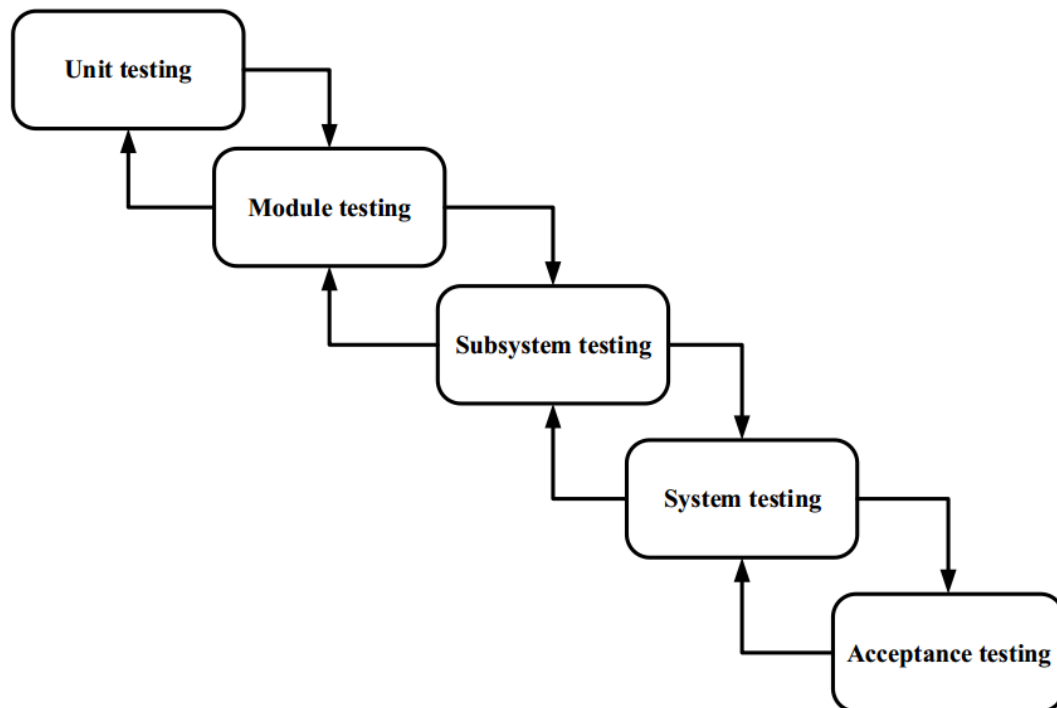


Fig 5.1 Testing process

5.3.1 Unit testing

Unit testing is a procedure whereby the individual modules are tested before they are integrated into units that will then be used to test the interface between the units (Saleh, 2013). Unit testing help to detect execution errors and this help the developer to take corrective measures. This is

done by the analyst having in mind that there might be some logic errors that may not be noticed during desk check and this may cause the system to malfunction thereby posing danger on the organization's operations when installed into full operational. The analyst carried out the testing procedure on all individual programs before they were integrated into one working system. Under unit testing the analyst tested the rental space approval module and it was successful.

5.3.2 Black-box testing.

Hudges and Cotterell (2009), explained that black box testing is a testing procedure whereby the analyst performs the test with the knowledge of the anticipated results of a queried module but without the knowledge of the processes involved in coming up with the results. Black box testing must apply to the whole system (Lester, 2014). A good example is whereby the analyst knows the results of the project but without the knowledge of how the system is getting to that output.

```
To: collen@gmail.com
Subject: ZIMDEF_processed_app

if you dont have an account use your email as your username : collen@gmail.com and password : 30979117 process your application has been accepted please continue
|
```

Fig 5.2 Black-box testing.

5.3.3 White box testing

White box can also be called glass box testing or structural testing and is mainly concerned on the inmost functioning of the element of the module (Eppingner, 2008). White box testing is a testing technique whereby pure information of system is verified, internal works are brought together to allow the analyst to choose the test data.

5.3.4 Module testing

According to (Dabbs, 2002), module testing is a rational summation of the individual units tested and these independent modules are then tested so as to identify the interfaces and their association. The system modules are combined together in order to test if they are compatible with each other (Graham et al, 2012). The analyst calculated the reliability and functionality of the mechanisms of the system setting the objectives in module testing.

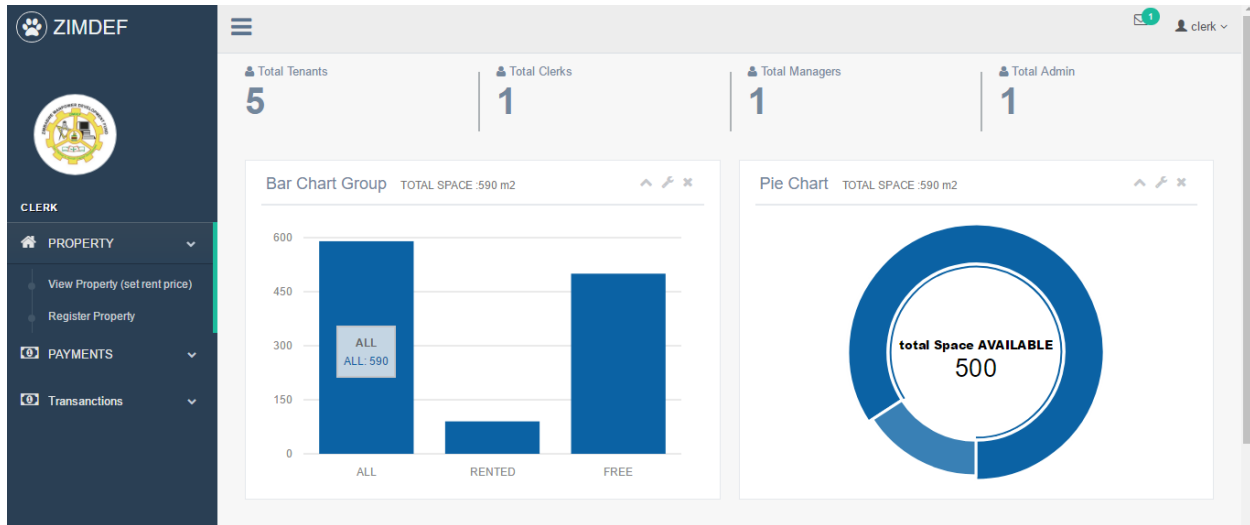


Fig 5.3 Module testing.

5.3.5 Sub System testing

Sub system testing is also known as link testing (Kendall and Kendall, 2011). With sub system testing all the system modules are brought together for integration and tested as a sub system (Osheron, 2013). This kind of testing gives the analyst a chance to test the functionality and compatibility of the modules.

5.3.6 System testing

According to Desikan (2006), system testing is a process where data is gathered to aid the testing of the system components. The process ensures the integration of a complete system modules for the testing purpose. In addition, Dawson (2009) explained that the system test inspect how the system will achieve the requirements of the organization, its performance, security and usability under considerable and full load. Therefore the analyst must input all the necessary data into the system in order to find out if the system is performing as expected. This allows the analyst to notice if there might be any errors that may cause the system to malfunction when put into operational.

5.3.7 Acceptance testing

Acceptance testing is more focused on the developer having a full depiction of the new system whether it has been accepted by the users or not (Kendall and Kendall, 2011). Acceptance testing is regarded as the last phase in system testing. Therefore the feedback from the system users is

very crucial and this is the reason why this testing has to be conducted. The developer used two methodologies in carrying out acceptance testing namely beta testing and alpha testing.

Beta testing – beta testing is whereby a sample of users is taken to have a feel and interact with the new system (Dustin et al, 1999). In addition, Duffy (2011) further explained that this process can be done by inviting independent users outside the organization to test the new system. These selected users will test the system at the external location so as to conclude whether it satisfies the needs of the users or not.

Alpha testing – According to Saleh (2013), alpha testing is a process whereby the system is tested using invented data. This kind of testing is different from beta testing since it takes place at the location of developers who then notice the behaviour of the system users as well as noting the problems. The developers will take corrective actions when problems are noted and this test is carried on until all the functional requirements are met by the system so as to make sure that it is fully functional.

5.3.8 Testing strategies

There are various testing strategies that the developer used to verify and confirming that the system performs as expected. Syntax and logic errors were noted by the developer and corrective measures were taken.

5.3.8.1 Validation

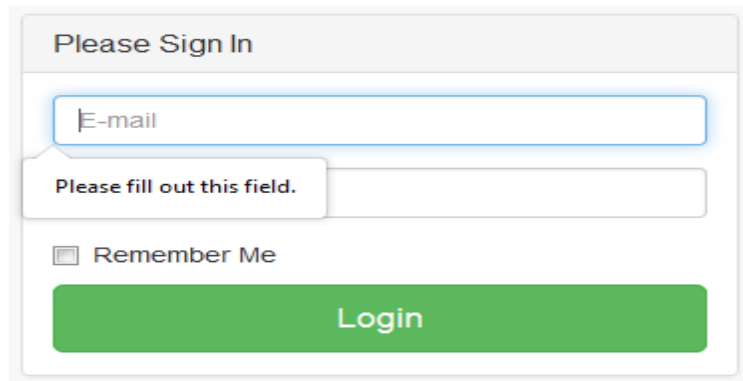
According to Fairly (1997), validation is a procedure that is used to assess whether the inputted data is sensible though it does not check the accuracy of data. Validation is of paramount importance in making sure that a viable system is delivered to the hands of the user (Vermaat, 2012). With validation, the inputted data must comply with the validation rules. For this reason the system went through various stages in order to detect the system errors so that they can be rectified. The system alerts the user by displaying error messages when the inputted data do not conform to the validation rules. The system must reject the invalid data inputted by the user.

5.3.8.2 Test cases

The tests were conducted using valid and invalid data in order to check the quality of the output produced by the system.

Login Validation

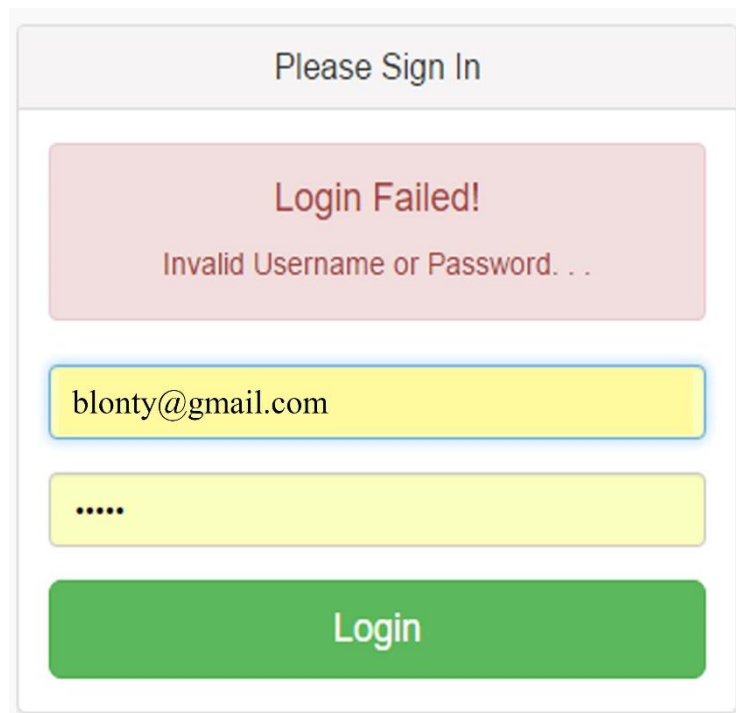
On the login form the user must enter the correct login credentials in order to gain access to the system. If user click on the login button without filling the required text boxes then the user is notified by the message that pops up.



The image shows a login form titled "Please Sign In". It contains an "E-mail" input field, a "Remember Me" checkbox, and a green "Login" button. A validation error message, "Please fill out this field.", is displayed in a white box with a grey border, pointing to the empty "E-mail" field.

Fig 5.4 Sign in validation

The error message below pops up if the user input invalid credentials upon login to the system.



The image shows the same login form as in Fig 5.4, but with a red error message box at the top that reads "Login Failed! Invalid Username or Password. . .". Below the error message, the "E-mail" field contains the text "blonty@gmail.com" and the password field contains five dots. The green "Login" button is still visible at the bottom.

Fig 5.5 Login validation

Application of property

To avoid useless applications, the potential applicants must enter their email address and then the system will send the code via their email. This code is then used during the application process.

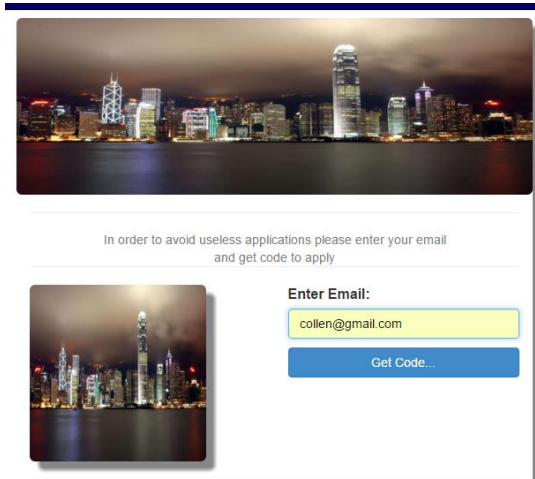


Fig 5.6 Get code

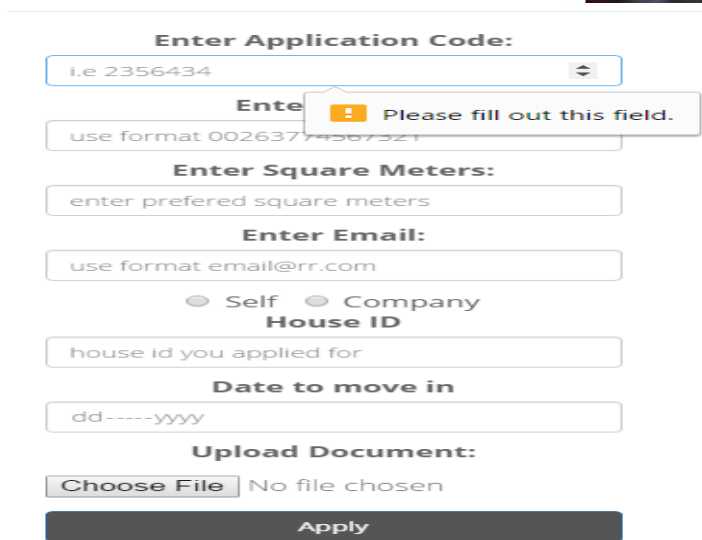
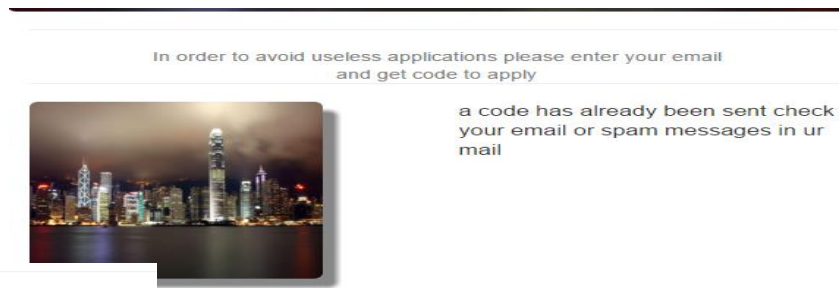


Fig 5.7 Application form

If the user click the apply button without filling the field will get a message prompting him/her to fill in the field

The system ensures that the tenant enters the correct email address by showing an error message below.

In order to avoid useless applications please enter your email and get code to apply

Enter Email:

collen#gmail.com

Get

! Please include an '@' in the email address. 'collen#gmail.com' is missing an '@'.

The image shows a web form titled "Enter Email:". Below the title is a text input field containing "collen#gmail.com". To the right of the input field is a green button labeled "Get". A white error message box with a yellow warning icon is positioned over the "Get" button. The error message reads: "Please include an '@' in the email address. 'collen#gmail.com' is missing an '@'." Above the form, there is a grey banner with the text "In order to avoid useless applications please enter your email and get code to apply".

Fig 5.8 Get code validation

5.3.8.3 Security testing

Security Testing refers to the procedures that are put in place to safeguard the data against unauthorised users (Stephen, 2015). This ensures data integrity as well as securing the organisation's data. The controls that were put in place to safeguard the organization's data include the use of different access levels and passwords.

Each user should view or access only the information that he/she is authorized to. The manager has the highest access level in the system and is responsible for performing crucial tasks. Below is a form that shows the manager access level. The different access levels promotes tight security.

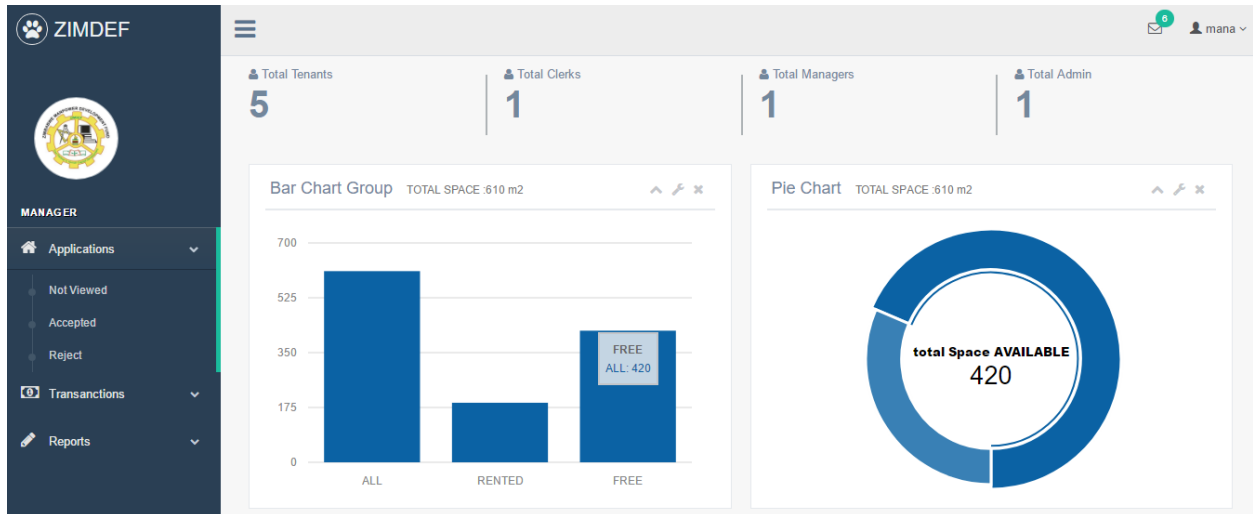


Fig 5.9 Manager access level

The clerk is responsible for registering the property, setting bills, approving the proof of payments among other tasks. Only the clerk will do these tasks as shown below. The clerk has the medium access level in the system.

The screenshot shows the Clerk's 'PROPERTY REGISTRATION' page. It features a table with the following data:

Property_ID	Square Meters	Date Acquired	Set Rent/Balance	Set Price Bill
1	200	2017-04-09	Edit	Edit
10	200	2017-04-25	Edit	Edit
11	200	2017-04-25	Edit	Edit
12	10	2017-04-28	Edit	Edit

Fig 5.10 Clerk access level

The tenants only access the information that they are authorised to. They only have access to the controls that they are entitled to use. The tenants have the lowest access level in the system.

ZIMDEF TENANT tenant ▾

Dashboard Home / House / Rent

PAYMENT <

Rented Property

Report <

Rented Property			
Transaction ID	Property ID	Square Meters	View
0	3	10	View
1	3	15	View
4	1	40	View

Fig 5.11 Tenant access level

Data integrity

This is a situation whereby the system ensures that the user inputs the correct data in the correct fields provided. This prevents the user from inputting invalid data.

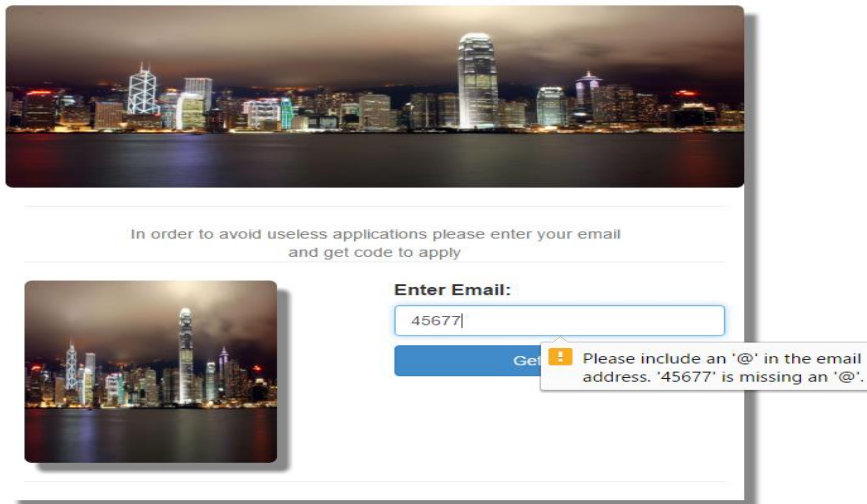


Fig 5.12 Integrity

Password protection

When the application is successful the system generates the username and password then send them via the applicant's email so that only the authorised user will be able to see the credentials hence promoting security.

To: collen@gmail.com
Subject: ZIMDEF_processed_app

if you dont have an account use your email as your username : collen@gmail.com and password : 30979117 process your application has been accepted please continue

Fig 5.13 Email

5.3.8.4 Physical security

Physical security is a process that ensures a safe working environment that is designed to curb access to the system from unauthorised users (Forouzan, 2007). The use of locks is a physical security that ZIMDEF put in place to ensure security of the company offices. Those without the keys will not be able to access the offices hence promoting security. ZIMDEF also employed security guards to monitor that no unauthorised person will take the hardware and the software out of the company premises.

5.3.8.5 Network security

According to Shelly and Rosenblatt (2012) network security is a procedure to safeguard the exchange of data among various devices or gadgets connected together. Network security is of paramount importance during system development as it promotes integrity, confidentiality, privacy as well as entity authentication. This instills confidence in users of the system since they know that their data is secure. Servers are used to monitor the system and other network resources. As a way of ensuring tight security, only authorized users will gain access to the servers through the use of unique usernames and passwords. Firewall was put in place as a security measure since it is capable of monitoring and controlling the outgoing and incoming network traffic based on the predetermined rules. The passwords will expire after every two months and the users are prompted to change them.

5.3.8.6 Operational security

According to Kendall and Kendall (2005), operational security is referred to as the non-existence of security related failures during the life of the system. At this stage the developer is concerned with the system weaknesses that maybe experienced during the operating life of the new system.

The analyst must therefore address these security issues that are likely to be encountered during the operational life of the system. Tackling these issues help to minimize the risk of hindering the operations of the system hence improving the performance of the system. All users were given unique usernames and passwords so as to prevent unauthorized users to access the system. These passwords will expire after every two months and the users are prompted to change them.

5.3.8.7 Verification

System verification is a process whereby the analyst inspect the system in order to make sure that the system meet the user requirements (Selah, 2004). The analyst must do the process repeatedly to in order to make sure that the system continues to satisfy the user requirements. At this stage the system is checked for accuracy.

5.3.8.7.1 System versus objectives

- ❖ To develop a system that allows the organization to advertise online, the available space to rent to potential tenants.

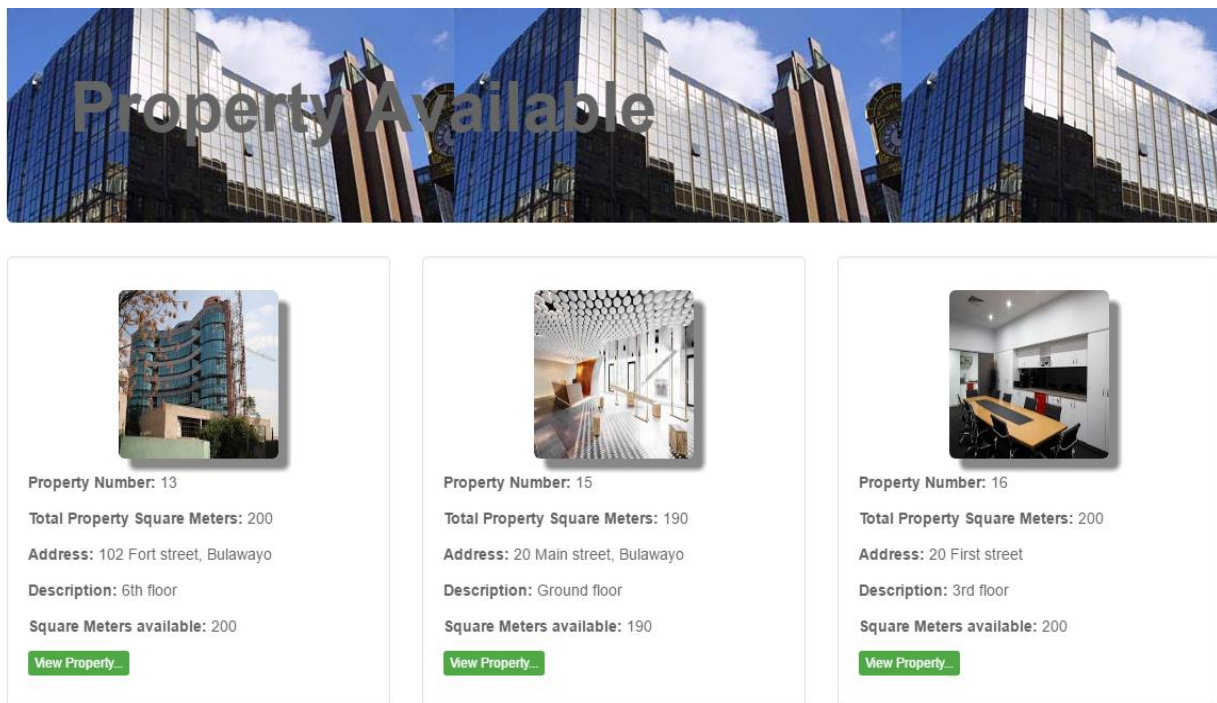


Fig 5.14 Objective 1

- ❖ To develop a system that allows potential tenants to apply for rent space online.

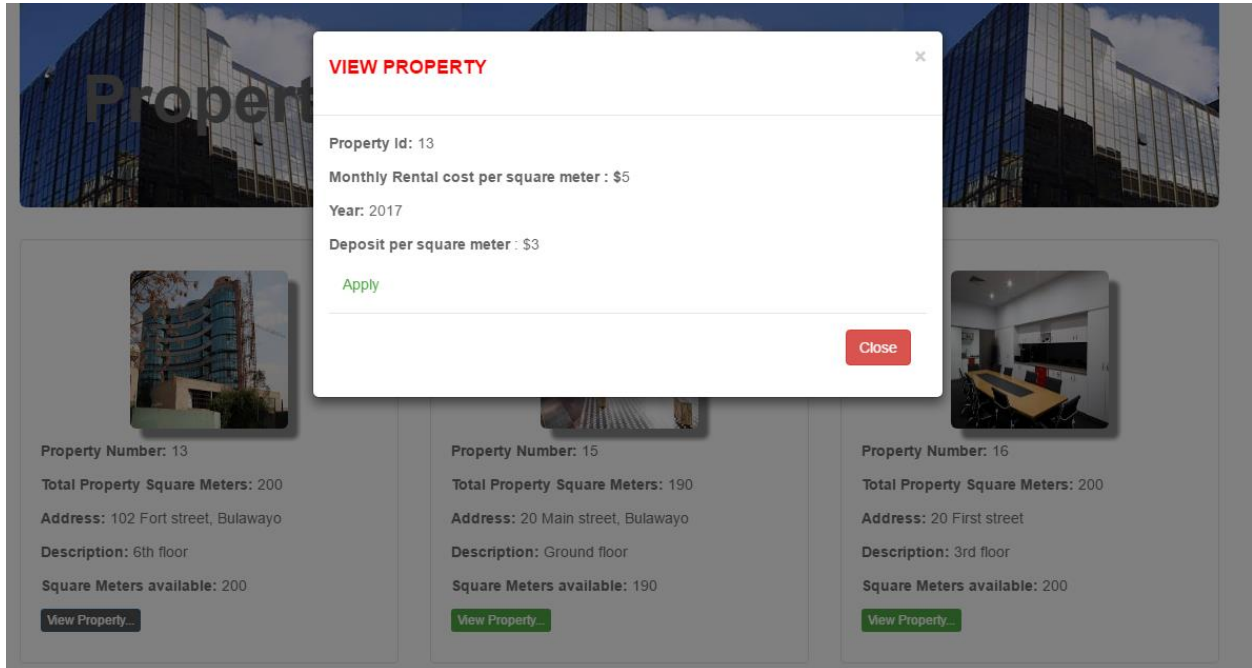


Fig 5.15 Objective 2

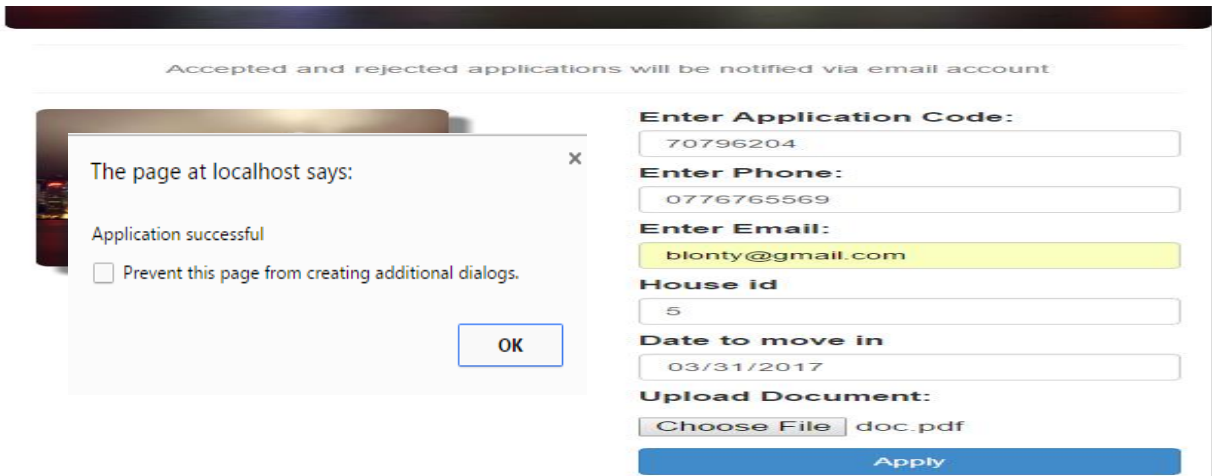


Fig 5.16 Objective 2

- ❖ To develop a system that allows managers to approve or disapprove the applications online.

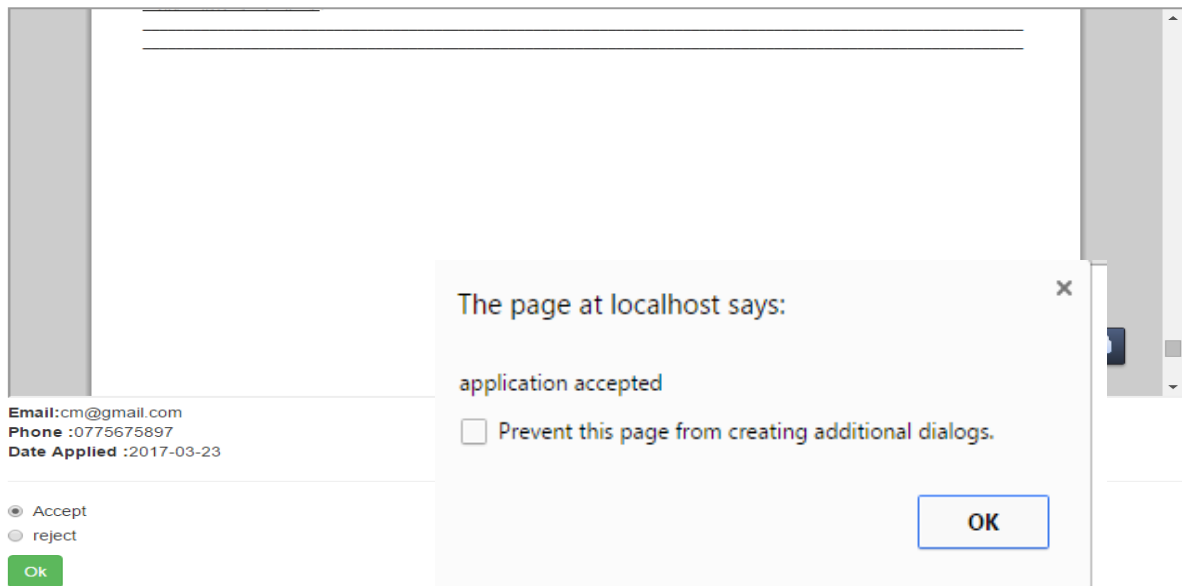


Fig 5.17 Objective 3

- ❖ To develop a system that allows the registration of successful applicants.

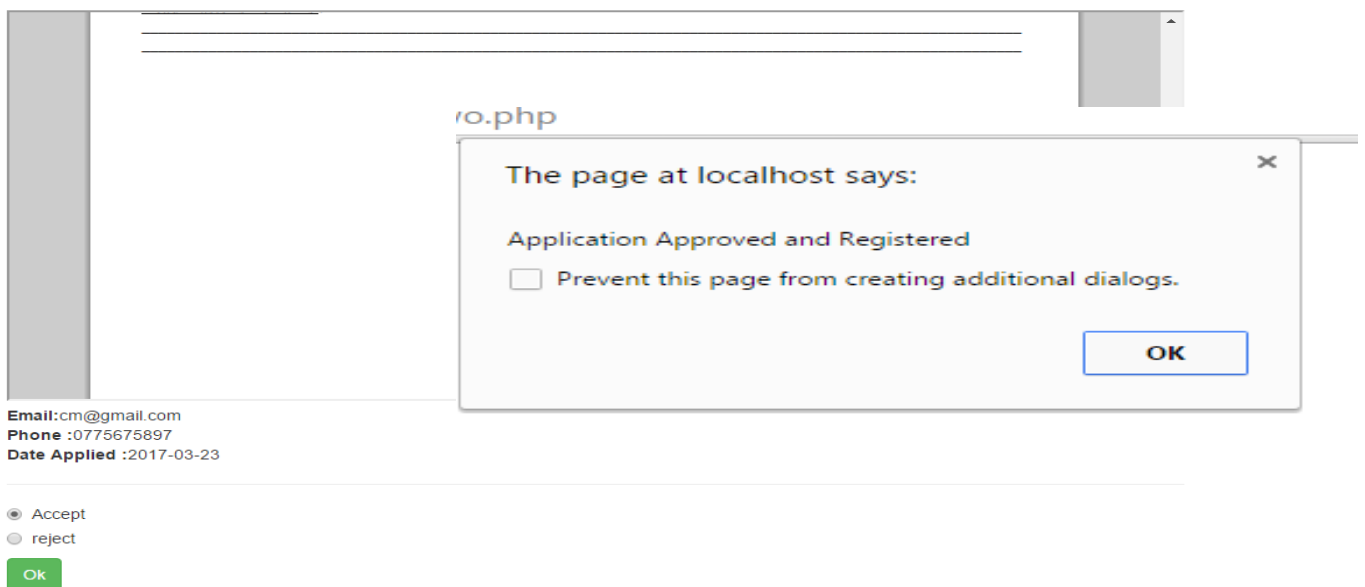


Fig 5.18 Objective 4

- ❖ To develop a system that calculates the bills of the tenants and sends the invoices to the tenants.

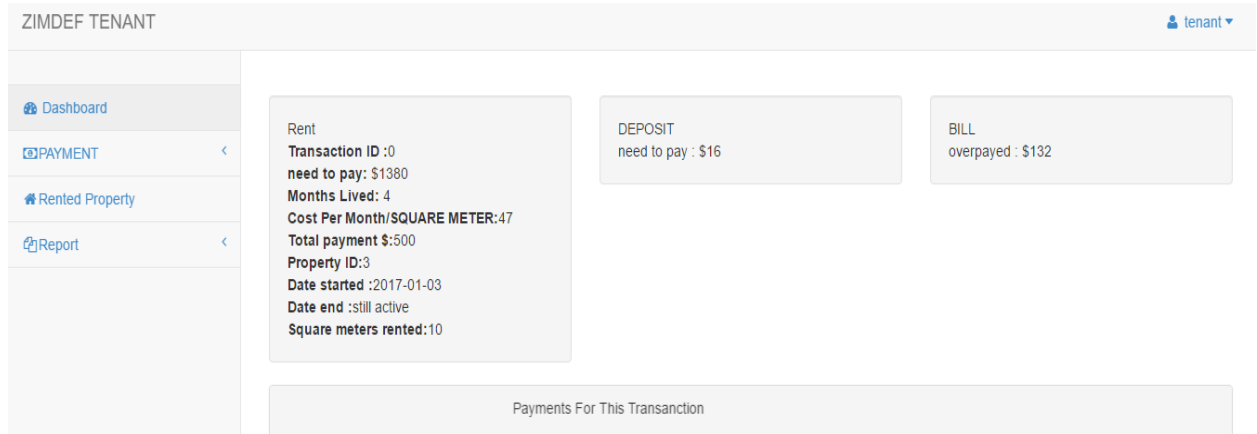


Fig 5.19 Objective 5

To: collenmusarira@gmail.com
 Subject: Zimdef Inc

You have an overpayment of \$132

Fig 5.20 Objective 5

- ❖ To develop a system that allows the tenants to upload the proof of payments online after paying their bills at the bank

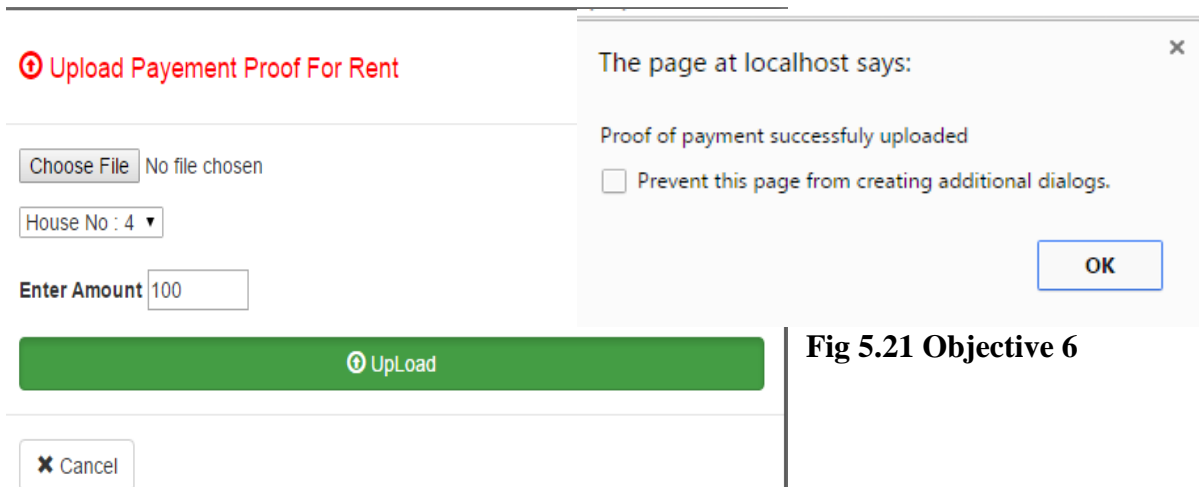


Fig 5.21 Objective 6

5.4 Installation

Installation is a processes whereby the new system is introduced to the working environment to replace the current system (Shelly and Rosenblatt, 2010).This process is regarded as the final stage of the system development since it comes after the proposed system passed through the various tests until it has proven to be fit for use. In addition, Hughes and Cottrell (2009) further explained that installation is whereby the new system is deployed for use in the real world environment. Installation consist of various activities such as system configuration, migration of data, user training and system changeover. During the installation of ZIMDEF Tenant Management System the steps below were followed:

- ❖ System configuration
- ❖ User training
- ❖ Data migration
- ❖ System changeover

5.4.1 System configuration

Crocket, (2008) stated that system configuration involves making the developed system ready for execution. It involves the copying of code from installation folders to a new location that is usually found in the local disc (C) of a computer for easy access of the installation files by the operating system of the computer. Before the system is installed for the user to use, it is important for the developer to first check that the system requirements necessary are met, the developer also have to check whether the existing software allow easy integration with the software versions that are in existence (Grady, 1997). Configuration of system files and creating links and shortcuts for easy access by the users has to be done also. The system was installed on ZIMDEF server. Before the installation the following steps were followed:

- ❖ URL was created for system users to access the system home page which is <http://localhost/ZIMDEF/index.php>.
- ❖ XAMPP server version 7.0 with MySQL database was installed.
- ❖ The system files were copied to the local disc (C) in a root folder that was automatically generated when XAMPP was installed called htdocs.

5.4.2 User training

According to Gilham (2008), system users must be trained before they get to use the system. This process helps the users to familiarize and interact with system and this is of paramount importance as it increase worker productivity. Power point presentations and projectors were used during the training sessions to aid quick understanding of the system by the users. There was also a question and answer session and this gave the users a chance to ask the trainer to shed more light on grey areas. After these sessions all the users had a clear understanding of how the system works. The training took a period of four weeks. All the system users were trained on how to use the system. The users were grouped into three groups which were managers, clerks and tenants. Managers were trained during the first week and clerks the following week. Tenants were grouped into two groups since they were many, therefore the first group of tenants were trained on the third week and the second group on the fourth week.

5.4.3 Data migration

Data migration is a process where data is extracted from the old system and loaded into the new system (Satzinger et al (2012). Chang (2005), added that data migration is a process that involves transferring data from various computer systems, storage devices and data formats. The organization was migrating from using manual system to a computerized system therefore the process of data migration was done manually. Proper security measures were taken during data migration since there are high risks of losing data. Therefore the users were awarded a chance to check if all their data was migrated without missing some. Validation and verification are the security controls that were used to ensure that data integrity is maintained.

5.4.4 Changeover strategies

According to Valicich (2009), defined system changeover as a technical process whereby the new system completely substitute the old system. This process comes immediately after the users have been trained. Proper system configurations was done during system changeover therefore the most appropriate changeover strategy was used. This was done to safeguard ZIMDEF operations from system failures. There are various changeover strategies that can be employed by the organization and these include pilot, phased as well as direct changeover strategies.

5.4.4.1 Direct change over

According to Ghezzi (2004), direct changeover is a procedure whereby the new system replace the old system overnight. The old system is considered obsolete immediately after the installation of the new system and all the operations on the old system are terminated. The users will then start to conduct their daily operations on the new system. Direct changeover is normally done during times of low production or on holidays to avoid disruption of users' operations. This is the quickest method to phase out the old system as well as the cheapest method among all the changeover strategies since only one system is used. However this method is associated with high risk of losing data if the system fails since there is no backup.

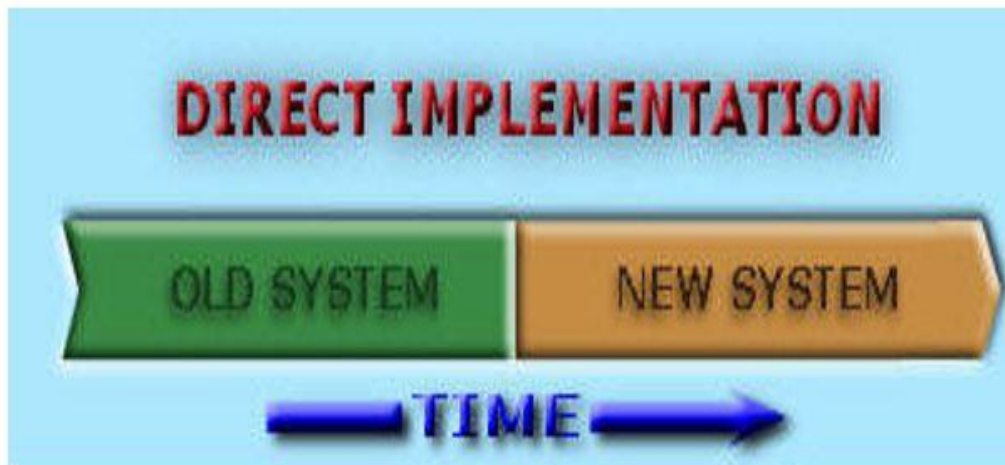


Fig 5.22 Direct changeover

5.4.4.2 Phased changeover

According to Duffy (2011), phased changeover is a process whereby the new system is implemented in phases. This process is also known as the continual or segmental replacement of the old system. This method gives the user a chance to familiarize with the new system while the old system is gradually removed until it is fully abandoned. There is limited risk of errors and system failures since the system is introduced in segments and this help to easily detect and correct errors.

5.4.4.3 Pilot conversion

Pilot conversion is a technique whereby the new system is implemented into a working environment while it will be working in the existence of the old system (Whitten, 2003). Therefore the two systems are made to run at the same time though on different platforms. The implementation of the new system is done on a small scale when using pilot conversion. This is done to assess the performance of the new system. This method is appropriate when there is high expectation of risks associated with the implementation of the new system. Therefore this method best minimize the risks.

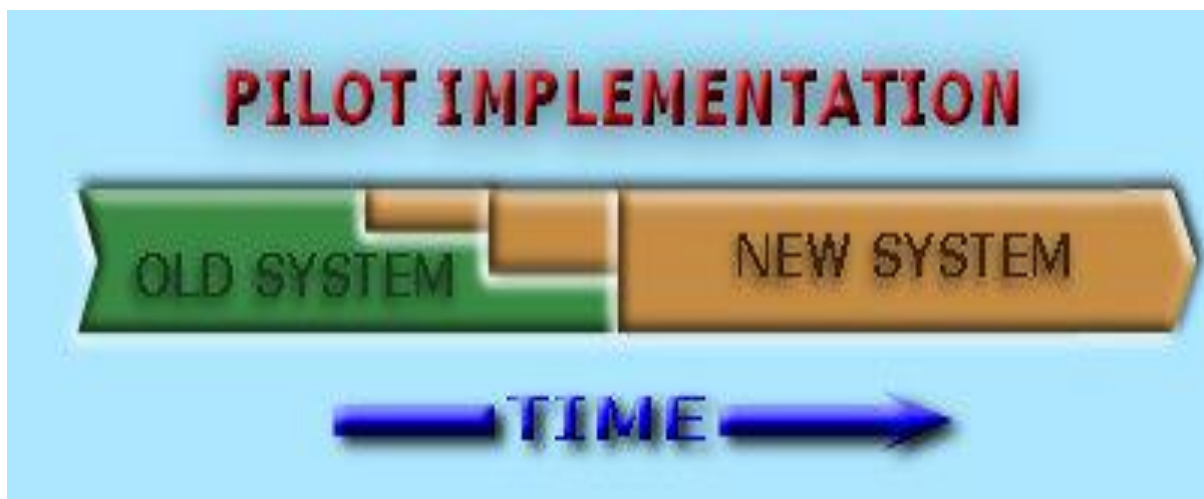


Fig 5.23 Pilot conversion

5.4.4.4 Parallel conversion

Parallel conversion is a process whereby the old and new system are allowed to run on a parallel bases for a specified period of time (Engel, 2010). This is done to ensure that users familiarise with the new system but not abandoning the old system. This conversion method is considered to be safest method among all the changeovers since there is proper backup of the system in the case of system failures (Whitten, 2003). Allowing these systems to run at the same time will allow the organization to curb the risks associated with the new system. Once a failure has been encountered on the new system then the organization can easily revert back to the old system. However this method is costly since there are two systems in operation.

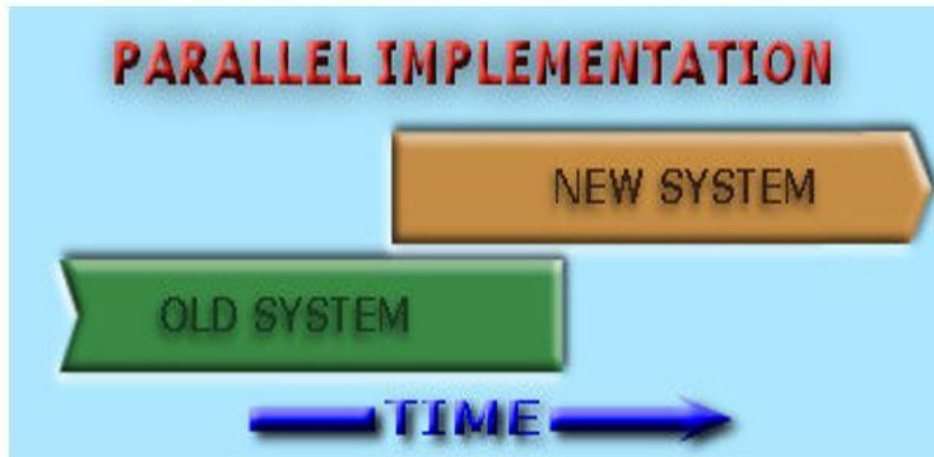


Fig 5.24 Parallel conversion

5.4.4.5 Recommended changeover strategy

After analyzing all the strategies above, as well as taking into consideration the manual system that was in place at ZIMDEF, the management and the developer agreed to use the direct changeover strategy. ZIMDEF had no finances to finance other changeover strategies hence it opted for direct changeover since it was the cheapest strategy. In addition, the skilled personnel was on standby to assist the users when they are in need of assistance. All the information was copied to the new system and the old system was rendered obsolete once the copying process was completed. Direct changeover was done during the public holiday so as to avoid disrupting the users' operations.

5.5 Maintenance

Maintenance is a process whereby the system is evaluated, monitored as well as modified so as to make sure that it is improved in line with the business operations (Valacich, 2012). This must be a continuous process during the life of the system in order to make sure that it continues to save the purpose for which it was developed as well as meeting the changing needs of users. In addition, Sommerville (2007) explained the system should be reviewed on a regular basis. Below are the ways that can be employed during the maintenance process.

- ❖ Corrective maintenance
- ❖ Perfective maintenance

- ❖ Adaptive maintenance
- ❖ Preventive maintenance

5.5.1 Corrective maintenance

According to Krugman (2009), corrective maintenance is whereby the programmer modifies the system due to errors encountered on the system. In addition, Somerville (2007) explained that corrective maintenance is a process whereby changes are done to the system in order to eliminate the errors that may occur during its life time. Changing the data formats is an example of corrective maintenance. Incorrect reports produced and data inconsistency are the examples of the errors that need corrective maintenance. After the system has been modified or maintained, there is need for the system to be assessed to see whether the system is error free or not. Corrective maintenance can be done when the user encounters a problem. It can take place at any time therefore there is no fixed time assigned for this maintenance.

5.5.2 Adaptive maintenance

As a result of the changing environment, the development of the information system must make it possible for the system to adapt to the changing environment. The system should be developed in such a way that changes can be done to suit the existing environment (Valacich et al, 2012). Adaptive maintenance is a process whereby the new system adapt to diverse running environment. All the changes regarding to adaptive maintenance must be documented to assist in the future maintenance Ibid. Adaptive maintenance will take place during public holidays so as to avoid interrupting the users' operations.

5.5.3 Perfective maintenance

Perfective maintenance is process whereby the programmer makes some additions of omitted functions to the new system (Clifford, 2000). This means that the programmer will implement an improved version of the system. In addition, (Schwalbe, 2009), described perfective maintenance as an activity of altering the implemented system by making additional features with the purpose of improving the system performance. Once the perfective maintenance is considered feasible, then the system will be put into operational. Perfective maintenance will take place during public holidays of April, August and December since the holidays are quiet longer therefore the programmers will have more time to test the system functionality.

5.5.4 Preventive maintenance

Preventive maintenance is an analysis and identification of errors or obstacles that may hinder the performance of the system (Berndtsson, 2008). Therefore the organization must take preventive controls and methods as a counter measure to curb system failure. These adverse effects must be acted upon by the organization prior they harm the operations of the organization. The use of sound security policies and up to date antivirus are the examples of preventive maintenance. Preventive maintenance will take place after every six months and will be done during weekends since users will not be at work.

5.5.5 Recommendations for maintenance

There were measures that the developer and the management put in place for the maintenance of ZIMDEF Tenant Management System so that it continues to serve its purpose. As a result of the fast changing technological environment, the analyst recommended the organization to take adaptive maintenance after every three months unless the users encountered some challenges. Under preventive maintenance the analyst advised ZIMDEF ICT team to make sure that they use firewalls and updated anti-virus to avoid threats of viruses.

5.6 Recommendations for future development

Having completed all the implementation stages and all the necessary activities that made the project a success, the developer noticed gaps that may need to be addressed in the future. The analysts made the following future recommendations:

- ❖ The analyst recommended that the system should be inter linked with other systems employed at ZIMDEF in order to improve productivity.
- ❖ It is recommended that the system should be made available on android application so as to allow tenants, clerks and managers to access the system on their mobile devices so that work can be done on remote places.
- ❖ The system must be able to inform the tenants of their bills via text messages.
- ❖ The system must send reminders to the tenants who have arrears on their bills to pay up.
- ❖ The system must be linked with the bank so that tenants will no longer have to upload the proof of payments.

- ❖ The system should be linked with other financial services such as ecocash, telecash and onewallet to ensure convenience during payments of bills.

5.7 Conclusion

After conducting a thorough system testing as well as implementation of ZIMDEF Tenant Management System, the project was considered a success. This was as a result of employing the appropriate testing, conversion, changeover strategies and maintenance. The system met all the objectives and user requirements and eliminated all the problems that were encountered as a result of using the old manual system. The recommended maintenance strategy should be used as advised by the analyst so as to prolong the system's life span. The future recommendations should be followed so as to improve the productivity of the organization.

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Appendices

Appendix A: User Manual

Login

The system users enter the correct login details so that they will gain access to their accounts. After inputting the correct username and password then the user must click the login button in order to gain access to their accounts.

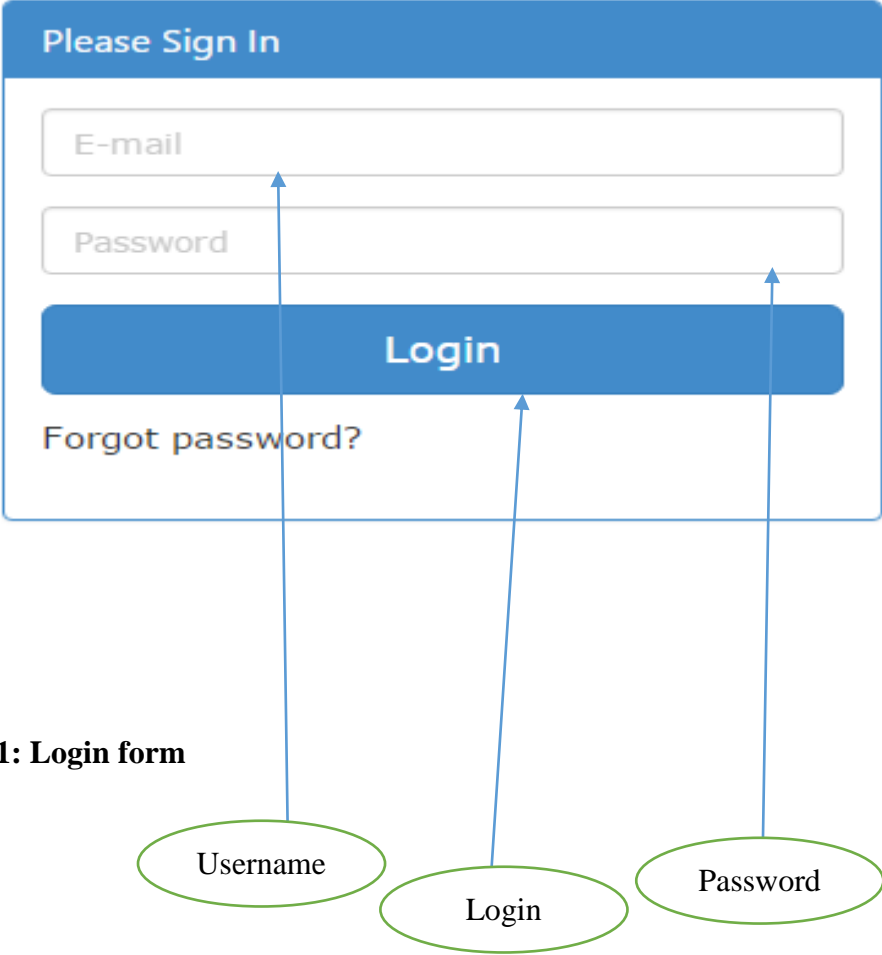


Fig A 1: Login form

Home page

The home page is the system’s first page. The users can login to the system by clicking the login tab. Tenants can view the advertised space by clicking on the properties tab.

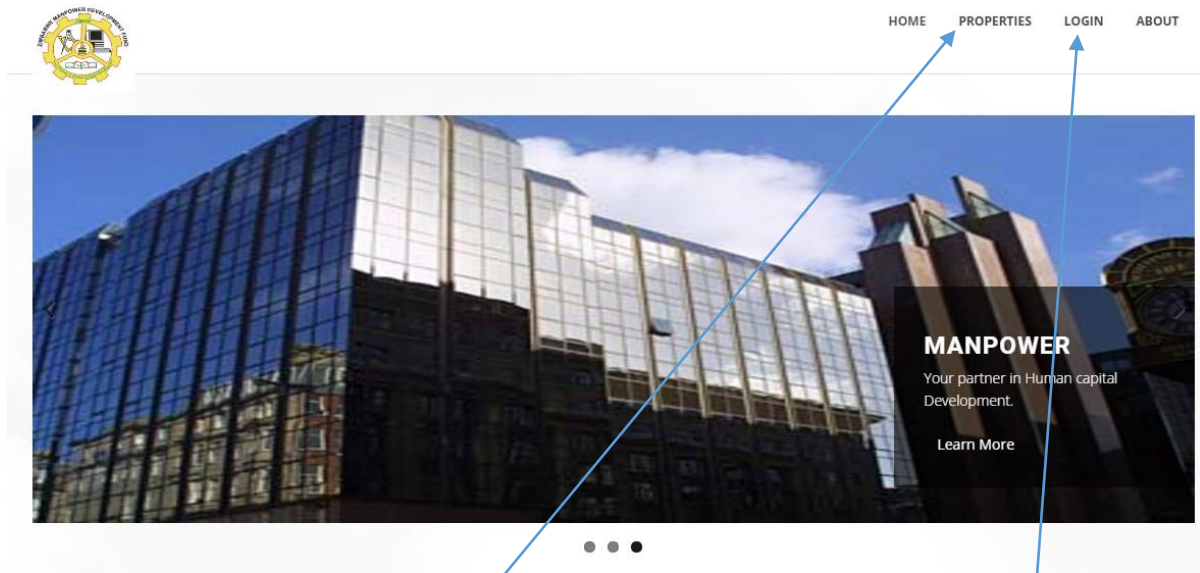


Fig A 2: Home page

View advertised properties

Login here

Main menu:

It displays the menu controls which can be used by the users of the system. By merely clicking on the menu control the subsequent form is shown. Then the users can continue with the tasks which he/she desires. The figure below shows the manager menu window.

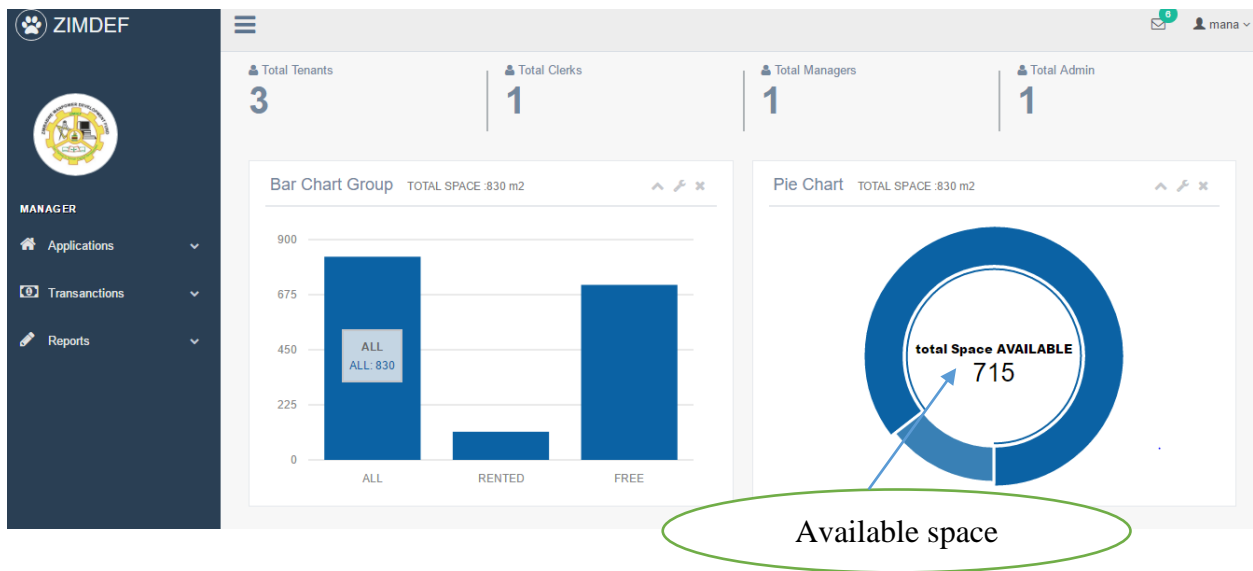


Fig A3: manager main menu

Below is a clerk main menu

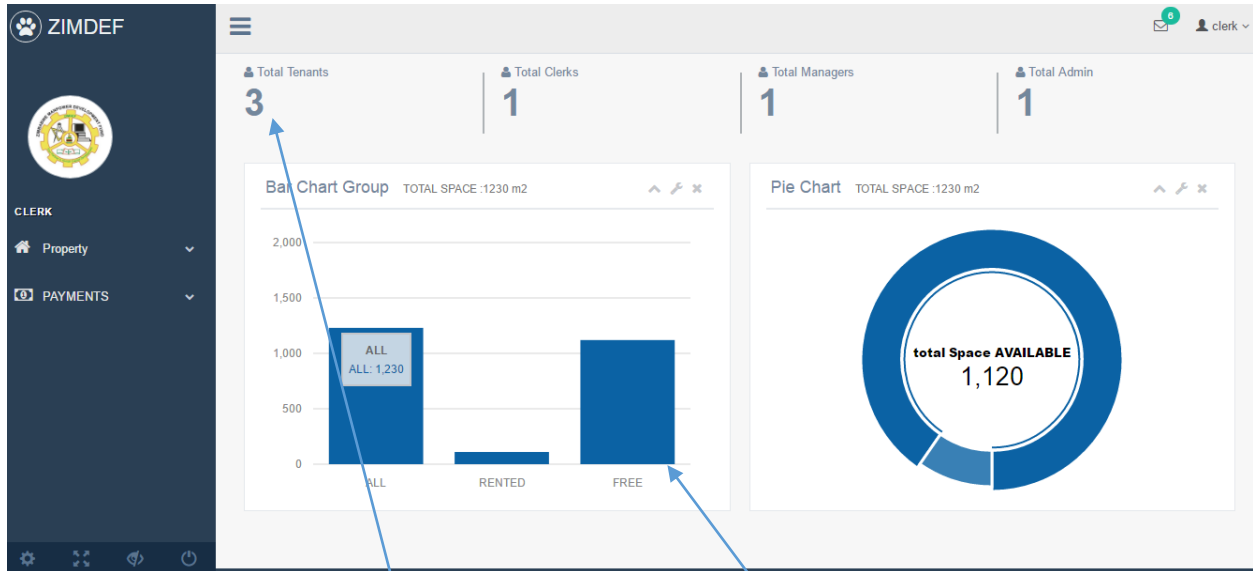


Fig A4 Clerk main menu



Below is a Tenant main menu

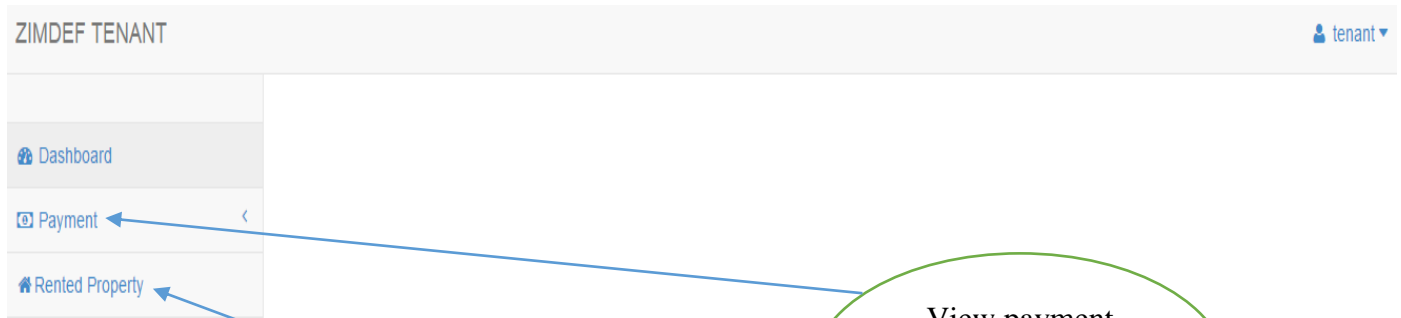
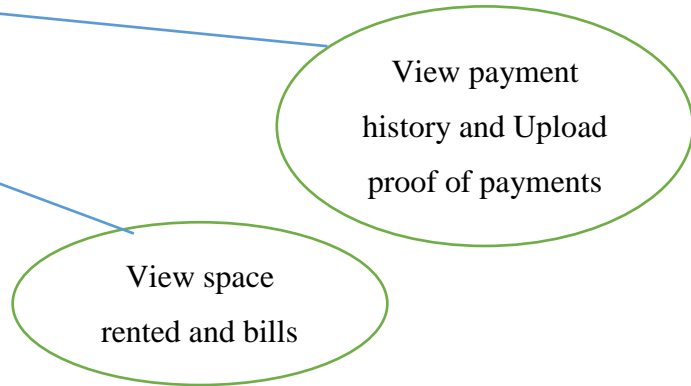


Fig A5 Tenant main menu



Below is a form that the clerk registers the property to be advertised. Clerk must click the property link and then click register property.

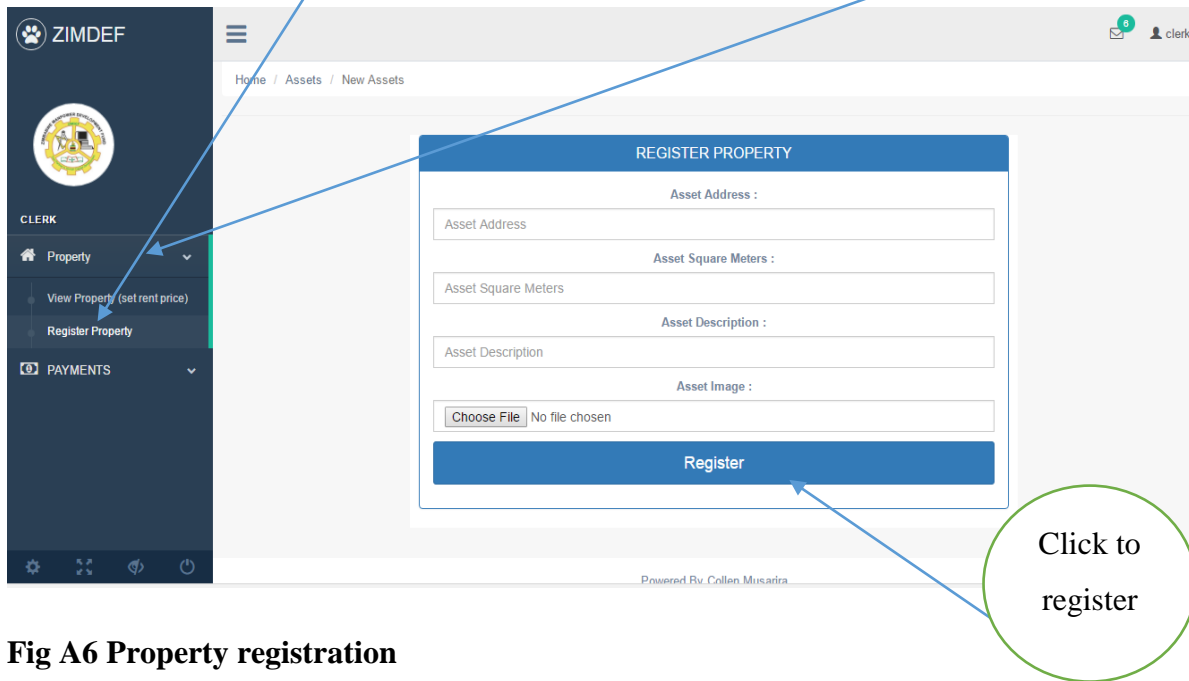


Fig A6 Property registration

The clerk must fill in all the details and click the register button to register property.

Once the clerk registers the property, he/she has to click the set price link to set the bills. The clerk must fill in all the text fields and click the set button to set the bill.

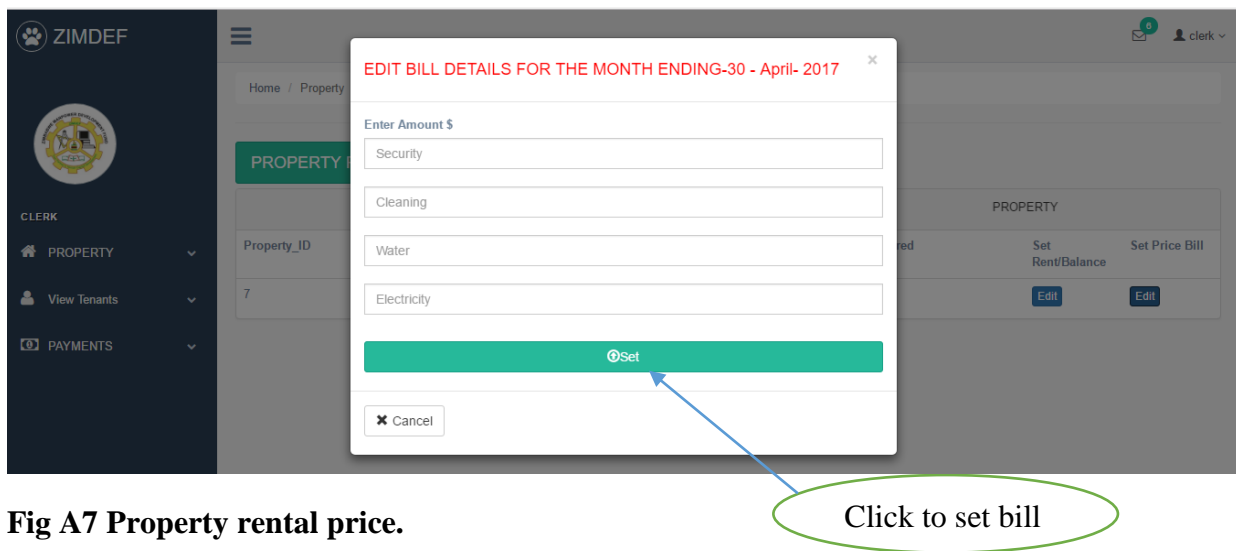


Fig A7 Property rental price.

The clerk must set the price of property per square meter and select whether its rent or deposit and then click update button to advertise the property. The form below shows the steps to set the price.

ZIMDEF House For tenants To Rent

Date Registered: 2017-04-12
Square Meters : 400
Description : ejkdjk
Physical Address : dfkdjk

codza inc

Enter Rental Amount For This Property

5

Rent
 Deposit

Update

Fig A8 Update property rental price.



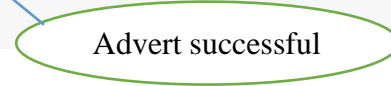
Once the update button above is clicked the message below informs the clerk that the advertisement is successful.

ZIMDEF

ADVERTISED successfully

clerk

Fig A9 Advertisement message.



The clerk must click the payments link and then click rents to view the payments that are not yet approved, view the accepted payments and rejected payments.

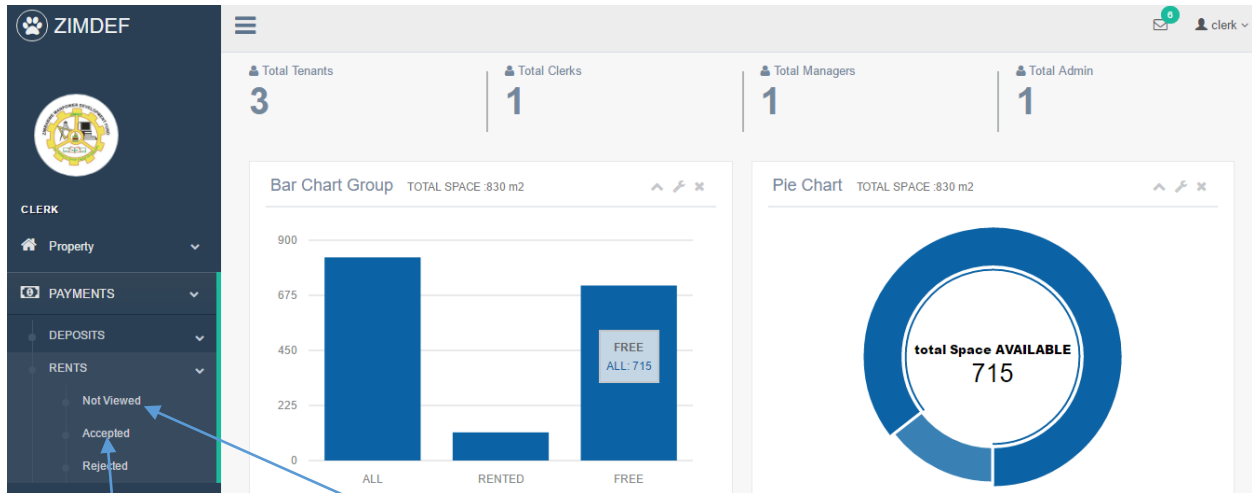
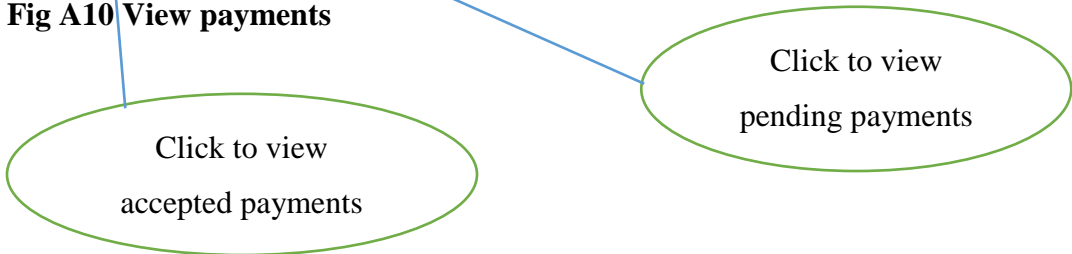


Fig A10 View payments



If the clerk clicks the accepted link above the following form will pop up showing the payment status yes, meaning that the payment was accepted.

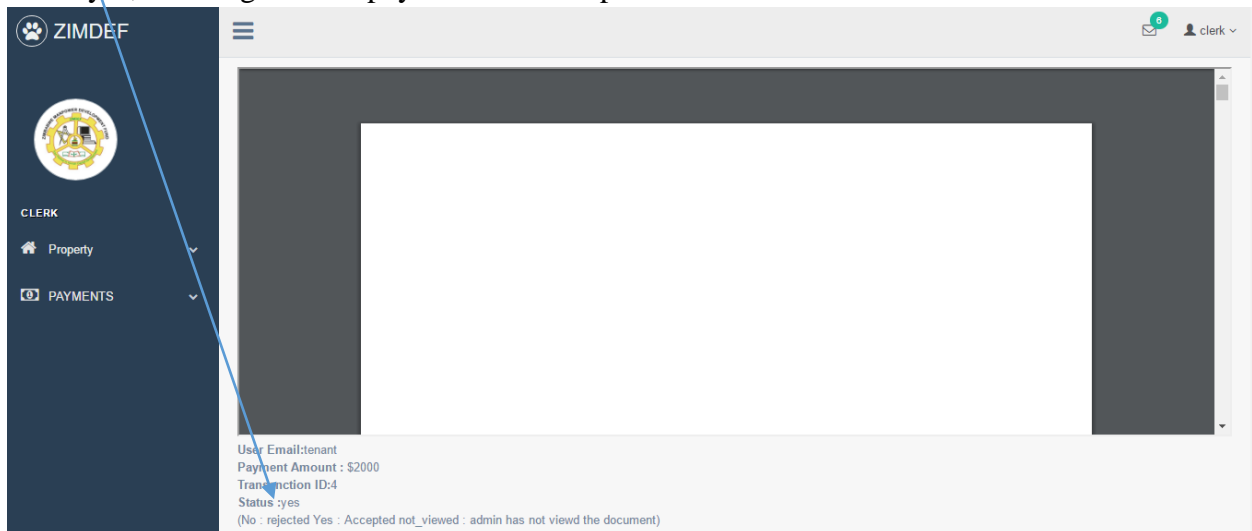


Fig A11 View payments status

Potential applicants will visit ZIMDEF website to view advertised space for rental and click view house to view the details of the property.

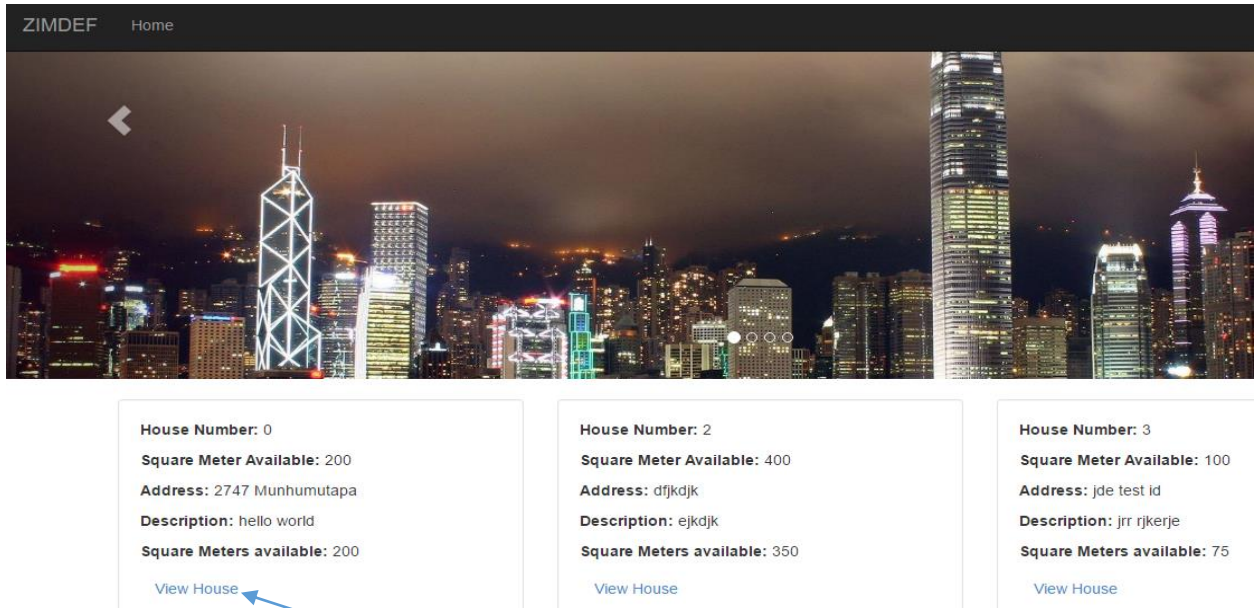


Fig A 12: Property advert

Click to view property details

When satisfied with the charges the tenant proceed by clicking the apply button on the form below.

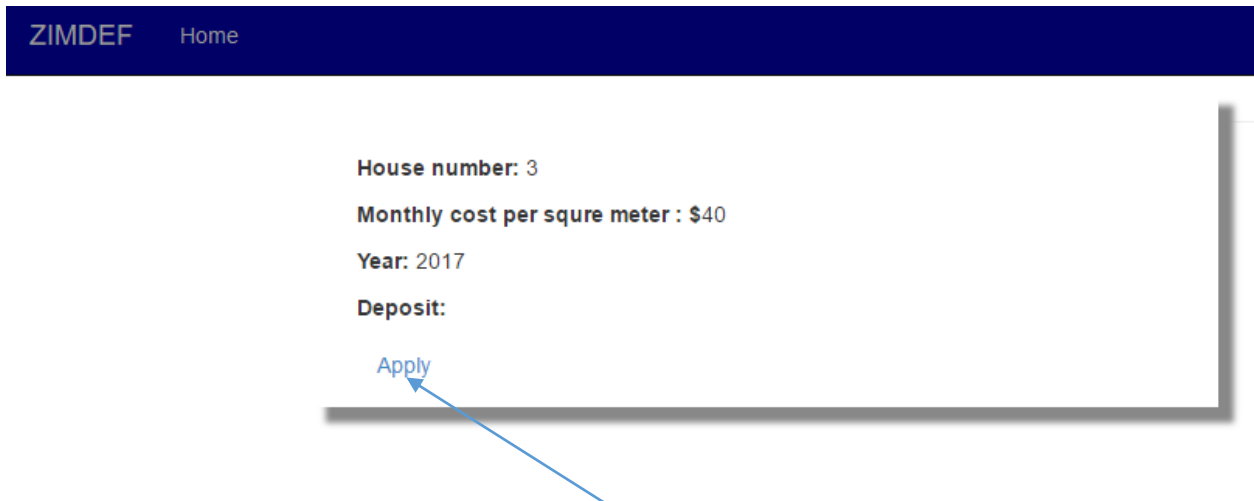


Fig A 13: Property details

Click to apply

Once users click the apply button they will be prompted to enter their email address so that they receive the code they must use during their application process. After entering the email the users must click the get code button and then their email accounts for the code.

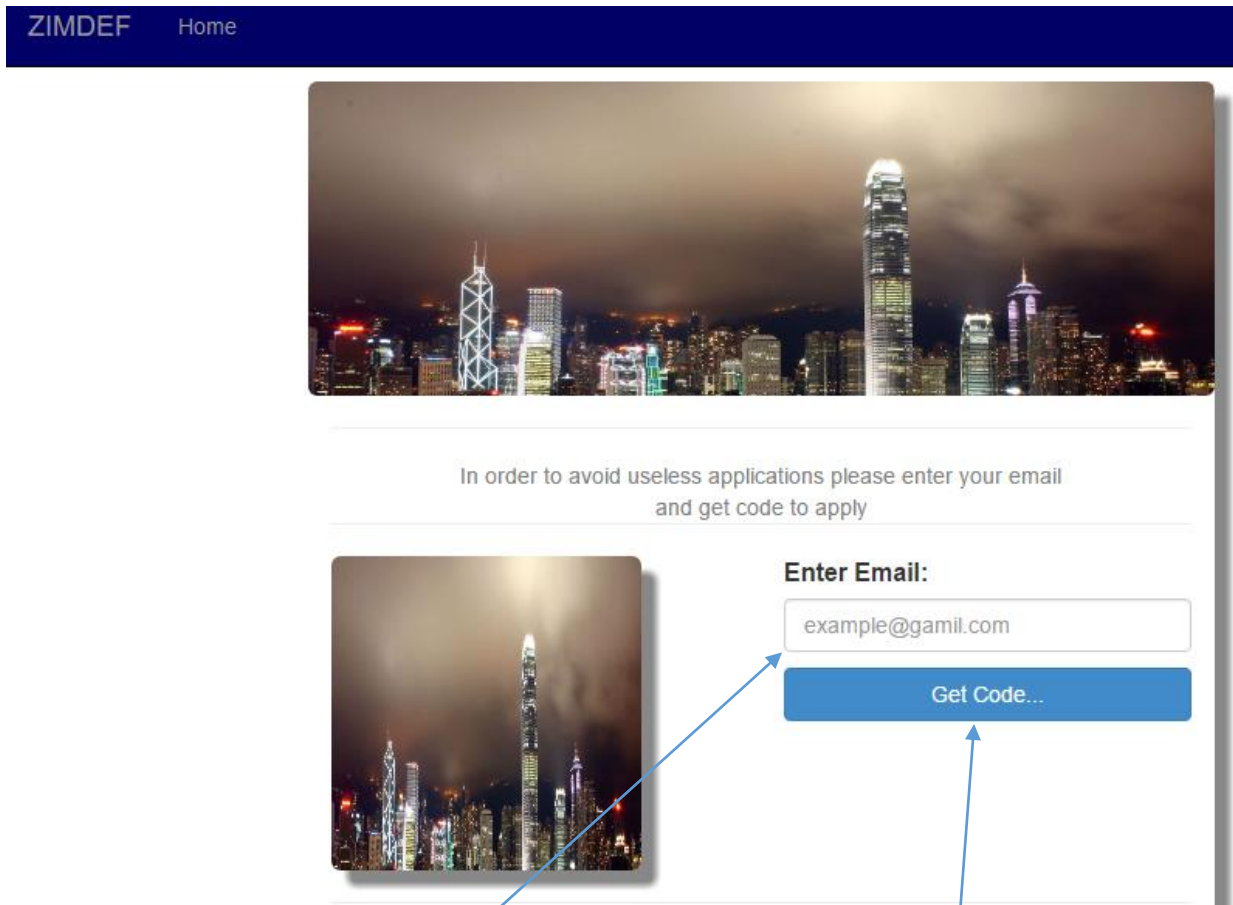


Fig A 14: Get application code

Enter email

Click to get code

After getting the code from the user email the following form will pop up prompting the user to enter the code and all the necessary details as well as uploading the filled application form that

can be downloaded on the website. After filling all the details the user must click the apply button to finish up the application process. The user must fill in all the fields.

The image shows a web application form with several input fields and a submit button. The fields are labeled as follows:

- Enter Application Code:** Input field with placeholder text "i.e 2356434".
- Enter Phone:** Input field with placeholder text "use format 00263774567321".
- Enter Square Meters:** Input field with placeholder text "enter preferred square meters".
- Enter Email:** Input field with placeholder text "use format email@rr.com".
- House ID:** Radio buttons for "Self" and "Company", followed by an input field with placeholder text "house id you applied for".
- Date to move in:** Input field with placeholder text "dd----yyyy".
- Upload Document:** A "Choose File" button and a text area with "No file chosen".
- Apply:** A green button with the text "Apply".

Below the form, there is a link: "If you dont have form download the form [Here](#)".

Three callouts in green circles with blue arrows point to specific parts of the form:

- "Enter code here" points to the Application Code field.
- "Attach application Form" points to the "Choose File" button.
- "Click to apply" points to the "Apply" button.

Fig A 15: Application form

The manager must use his/her login credentials to gain access to the system. Below is the manager home page where he/she views the system users as well as the space occupation information. The manager must click the application link to view applications for approval. He/she can also click the transaction link to view the transactions made by the tenants. The manager can also view reports.

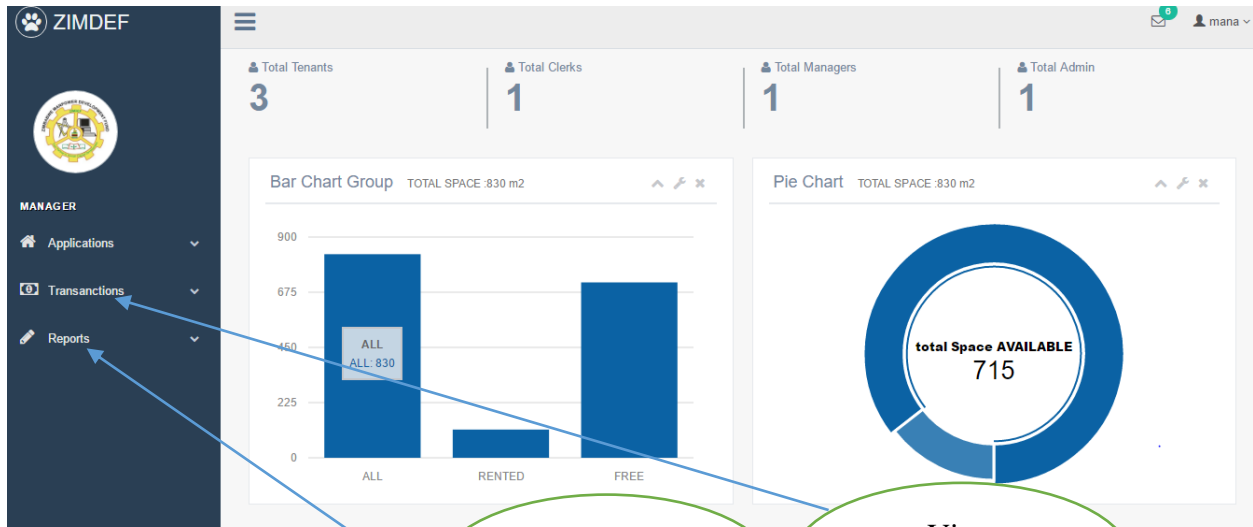


Fig A 16: Manager home page

Click to view reports

View transactions

The manager must select the accept or reject button to the to approve or disapprove the applications. After selecting must click the ok button to finish the approval process.



Fig A 17: Application approval

Click to finish

Reject application

Accept application

Once the application is approved by the manager the tenant is automatically registered and an email is send to the tenant informing him/her of the login credentials. The tenant must click the payment link to upload their proof of payments after they have paid their rentals through the bank.

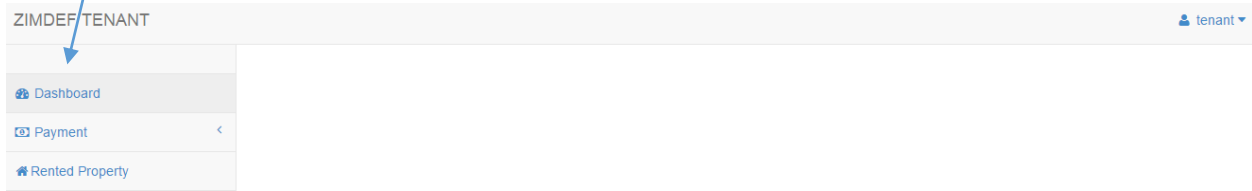


Fig A 18: Tenant home page

The tenant must click the upload proof of payment rent button to upload the proof.

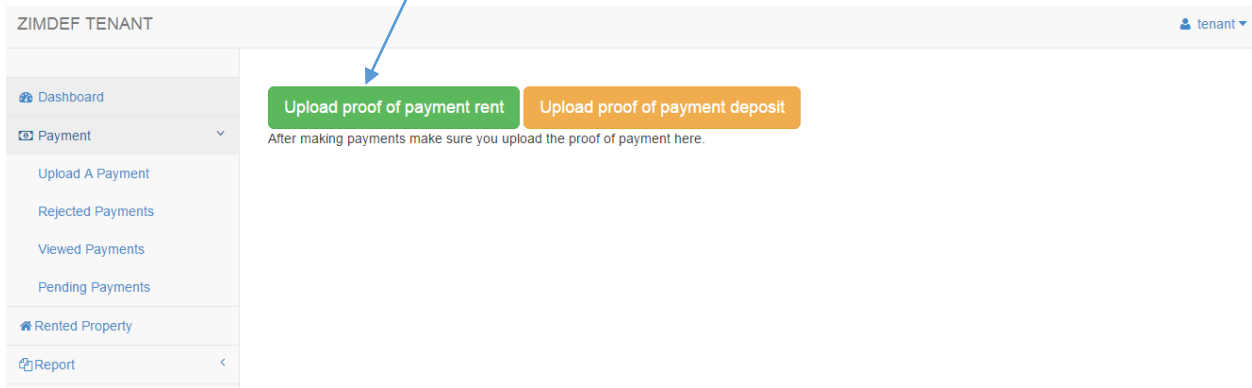
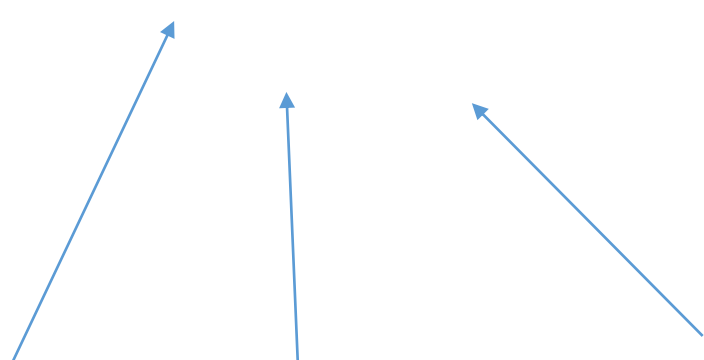


Fig A 19: Upload proof of payment

The tenant must click choose file to select the location of the proof of payment, then enter the amount paid and click upload button to finish the process.



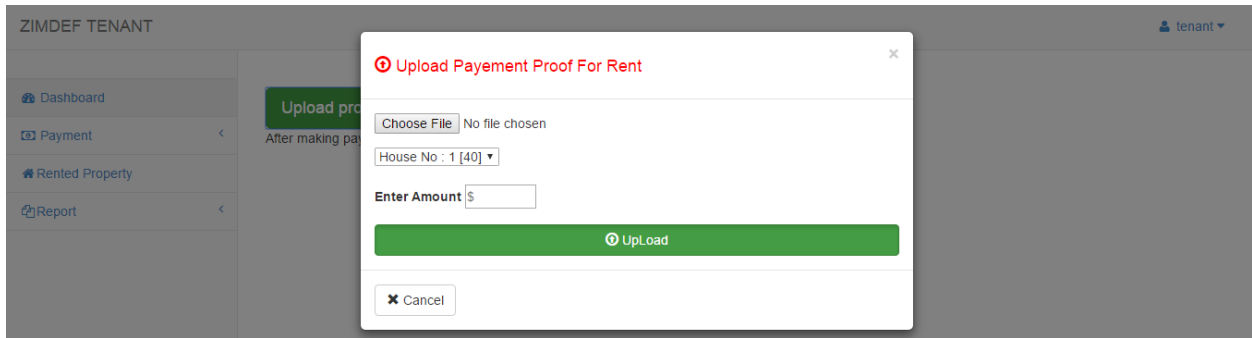
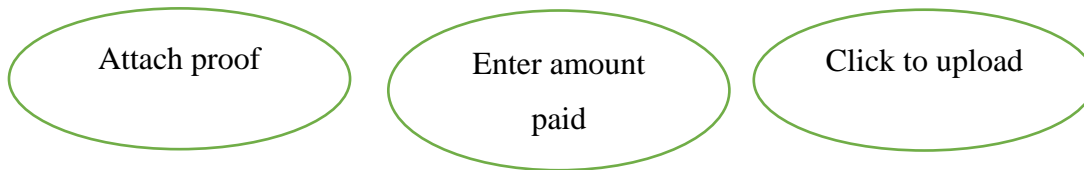


Fig A 20: Upload proof of payment for rent



The tenant can view the property they are occupying and the respective cost by clicking the rented property link. They can view their monthly bills and the payments.

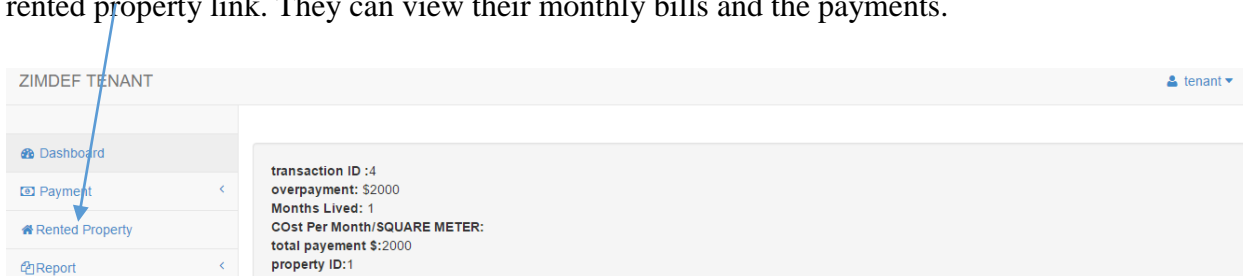


Fig A 21: Rented property

Wrong username and password on log in

Upon entering a wrong username or password on log in, an error message will pop up informing you that you have entered a wrong username and or password. The interface shown below appears when one enters wrong username and or password.

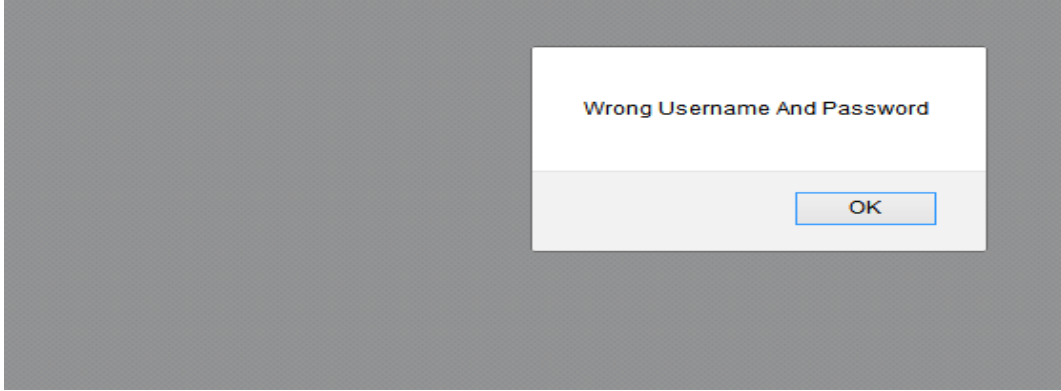


Fig A22: Wrong username and password

Appendix B1: Letter of consent to conduct a research

12 May 2016

TO WHOM IT MAY CONCERN

Dear Sir/Madam

REQUEST TO CARRY OUT RESEARCH AT ZIMDEF



Midlands State University

Faculty of Science and Technology

Department of Computer Science and Information Systems

NAME	Musarira Collen
REGISTRATION NUMBER	R134092T
MODULE CODE	HCS 401
MODULE NAME	Project Proposal
YEAR	2016
PROJECT TITLE	ZIMDEF Tenant Management System.

Handwritten signature in red ink

ZIMBABWE MANPOWER
DEVELOPMENT FUND
ACCOUNTANT
12 MAY 2016
ZIMDEF HOUSE, MEZZAINE FLOOR
122 HOGUE STREET
P.O. BOX 1700 HARARE, ZIMBABWE
TEL: 020 222 1125/9



Midlands State University
Faculty of Science and Technology
Department of Computer Science and Information Systems
P O Box 9055
Gweru

I am Collen Musarira, currently studying an Honours Degree in Information Systems at the above mentioned institution. The purpose of this interview is to collect information in preparation of my project titled “**ZIMDEF Tenant Management system**”. Your contribution is of paramount significance.

NB: This information will be sorely used for academic purposes

INTERVIEW QUESTIONS

Manager

1. How does your existing tenant management system work?
2. How are you coping with the existing system? Are there any problems that you are encountering using the system?
3. How do you rate the system performance?
4. Are there any precautions in place to safeguard against unauthorized access to any information?
5. What view/ opinion about migrating from the current system to a fully computerized system do you have?

6. Are you computer literate?
7. Are there any experts in software development at your organisation to carry out the project?
8. Do you have hardware and software resources to be used during the new system development?
9. What support are you prepared to give to ensure that the new computerised system be a success

INTERVIEW QUESTIONS

Accounts Clerk

1. How does your existing tenant management system work?
2. What are the problems that you are encountering using the system?
3. How do you rate the system performance?
4. Are there any precautions in place to safeguard against unauthorized access to any information?
5. Are you computer literate and to what level?
6. What do you expect from the new system?
7. What support are you prepared to give to ensure that the new system development be a success?

INTERVIEW QUESTIONS

Tenant

1. How does the existing tenant management system work?
2. What are the problems that you are encountering using the system?
3. How do you rate the system performance?
4. Are there any precautions in place to safeguard against unauthorized access to any information?

5. Are you computer literate and to what level?
6. What do you expect from the new system?

Appendix C: Questionnaire

Midlands State
Established 2000 University



Midlands State University
Faculty of Science and Technology
Department of Computer Science and Information Systems
P O Box 9055
Gweru

I am Collen Musarira, currently studying an Honours Degree in Information Systems at the above mentioned institution. The purpose of this questionnaire is to collect information in preparation of my project titled “**ZIMDEF Tenant Management system**”. Your contribution is of paramount significance.

NB: This information will be solely used for academic purposes

Please note:

- Do not write your name or any personal details on the questionnaire.
- The information gathered will remain private and confidential and only be used for academic purposes.
- Indicate by a tick where applicable.

Questionnaire

Manager and Clerk

1) How do you rate the current tenant management system?

- A. Excellent B. Good C. Fair D. Poor

2) Do you vote for the computerization of the tenant management system?

- A. Yes B. No C. Undecided.

3) Do you think the current system is reliable, efficient and contributing to your organizational objectives and goals effectively?

- A. Yes B. Uncertain C. No

4) Do you often experience very busy days and big workloads during your operations?

- A. Very often B. Infrequently C. All the time

5) Do you have complains about the current system's performance?

- A. Yes B. No

6) What are the challenges you are facing when using the current manual system

.....
.....

7. Do you think a computerised tenant management system will be of help to the organization and how?

.....
.....

9. Are the any expertise in software development at your organisation to carry out the project?

- A. Yes B. No

10. Do you have hardware and software resources to be used during the new system development?

- A. Yes B. No

11. What support are you prepared to give to ensure that the new computerised system be a success.....

.....
12.What do you expect from the new system.....
.....

Established 2000
**Midlands State
University**



Midlands State University
Faculty of Science and Technology
Department of Computer Science and Information Systems
P O Box 9055
Gweru

I am Collen Musarira, currently studying an Honours Degree in Information Systems at the above mentioned institution. The purpose of this questionnaire is to collect information in preparation of my project titled “ZIMDEF Tenant Management system”. Your contribution is of paramount significance.

NB: This information will be solely used for academic purposes

Please note:

- Do not write your name or any personal details on the questionnaire.
- The information gathered will remain private and confidential and only be used for academic purposes.
- Indicate by a tick where applicable

Questionnaire

Tenant

1) How do you rate the current tenant management system?

- A. Excellent B. Good C. Fair D. Poor

2) Do you vote for the computerization of the tenant management system?

- A. Yes B. No C. Undecided.

3) Do you think the current system is reliable, efficient and contributing to your organizational objectives and goals effectively?

- A. Yes B. Uncertain C. No

4) Do you often experience very busy days and big workloads during your operations?

- A. Very often B. Infrequently C. All the time

5) Do you have complains about the current system's performance?

- A. Yes B. No

6) What are the challenges you are facing when using the current manual system

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

7. Do you think a computerised tenant management system will be of help to the organization and how?

.....
.....

8. What support are you prepared to give to ensure that the new computerised system be a success

.....

9. What do you expect from the new system.....
.....

Appendix D: Observation Score Sheet

Observation guide schedule

Name of Observer: _____ Section: _____

Date: _____ Time: _____

Observation: _____

Conclusion: _____

Appendix E: Document Review Report

Reviewer Name	
Department under review	

Criteria	Documents Reviewed	Remarks
.....

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OVERALL DOCUMENT REVIEW REMARKS:

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Reviewer.....

Date **Time**

Appendix F: Code Snippet

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

// Create connection

$conn = mysqli_connect($servername, $username, $password, $dbname);

// Check connection
if (!$conn) {
die("Connection failed: " . mysqli_connect_error());
}
?>
```

```
<?php
ob_start();
?>
```



```

        <?php
        $_date = "width: 70px;
        float: left;
        border-radius: 4px;
        background-color: #008bc3;
        margin-right: 30px;
        margin-top: 4px;
        text-align: center;
        font-family: 'BebasNeue';
        color: #fff;
        font-size: 16px;
        padding: 3px;
        line-height: 20px;";
        $_date_in = " background-color: #fff;
        color: #008bc3;
        font-size: 40px;
        border-radius: 4px;
        line-height: 49px;
        margin-top: 3px;
        font-weight: bold;";
    ?>
</html>
<head>
<title>ZIMDEF</title>
<meta charset="utf-8">
<meta name="viewport" content="width=device-width, initial-scale=1">
<link rel="stylesheet" href="http://maxcdn.bootstrapcdn.com/bootstrap/3.3.6/css/bootstrap.min.css">
<script src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.0/jquery.min.js"></script>
<script src="http://maxcdn.bootstrapcdn.com/bootstrap/3.3.6/js/bootstrap.min.js"></script>

```

```

<!--Custom CSS-->
<link rel="stylesheet" type="text/css" href="boot/css/global.css">
<!--Bootstrap CSS-->
<link rel="stylesheet" type="text/css" href="boot/css/bootstrap.css">
<link rel="stylesheet" type="text/css" href="boot/css/bootstrap.min.css">
</head>
<body>

    <!-- Navigation -->

    <nav class="navbar navbar-inverse navbar-fixed-top" style="background-color:#000066;
    color: white;" >

    <div class="container-fluid">

    <div class="navbar-header">

    <a class="navbar-brand" href="#" >ZIMDEF</a>

    </div><div>

    <ul class="nav navbar-nav" >

    <li class="active"><a href="index.php" style="background-
    color:grey;">Home</a></li>          <li><a
    href="service_home.php">Properties</a></li>
        <li><a href="contact.php">About</a></li>

    </ul></div></div>

    <h1>ZIMDEF</h1>

    <p style="font-size:2.2em;font-family:'Freestyle Script';">your partner in Human capital
    Development.</p>

    <p style="float:right;">

        <button type="button" class="btn btn-warning btn-lg" style="background-color:grey;"><a
        href="cp-          user/" style="color:white;font:5px">Tenant Sign In</a></button></p>

        <a href="cp-admin/" style="color:white;font:5px">Admin Sign In12345678</a><br></div>

    </div></div>

    <div class="container-fluid" style="margin:0;">

    <div class="row" style="margin: 2px 50px;" >

    <div class="col-md-5">

```

```

<div class="row" >
  <div class="col-md-3"> 
</div><div class="col-md-9"> <h3 style="">STEM</h3></div>

<br><br>

  <p><h1>CONTACT</h1></p>

    <p>Locate us at <span class="glyphicon glyphicon-map-marker"></span>102 Fort
street<br>
    ,Bulawayo</p>
    <hr>

<p>Call us at <b><span class="glyphicon glyphicon-earphone"></span> <i> +263 974828</i></b></p>
<hr>

  <p>Email us at <b><span class="glyphicon glyphicon-envelope"></span><i><a href="mailto:
marketing @ zimdef.co.zw " style="color:white"> marketing@zimdef.co.zw</a></div>

<div class="col-md-2"></div>

  <div class="col-md-5">

    <p><h1>SOCIAL MEDIA</h1></p>

<p> Like Us</p>

    <p> Follow Us</p>

    <p> Subscribe To Our Channel</p></div></div>

</div>

  <div class="row" style="background-image: url('images/back.png'); color: white;" >

    <br><center style='color:#00CCFF;'>Copyright 2017 &copy; Collen Inc. All rights
reserved.</center><br></div>

</body>

</html>

  <?php
    ob_flush()?>

    Service apply

  <?php
include 'functions/function_validate_input.php';
include 'functions/function_check_house_existance.php';

```

```

include 'includes/db_connection.php';
include 'functions/function_property_space.php';
?>
<html>
    <head>
        <title>ZIMDEF</title>
        <meta charset="utf-8">
            <meta name="viewport" content="width=device-width, initial-scale=1">
            <link rel="stylesheet"
                href="http://maxcdn.bootstrapcdn.com/bootstrap/3.3.6/css/bootstrap.min.css">
            <script src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.0/jquery.min.js"></script>
            <script src="http://maxcdn.bootstrapcdn.com/bootstrap/3.3.6/js/bootstrap.min.js"></script>
        <!--Custom CSS-->
            <link rel="stylesheet" type="text/css" href="boot/css/global.css">
        <!--Bootstrap CSS-->
            <link rel="stylesheet" type="text/css" href="boot/css/bootstrap.css">
            <link rel="stylesheet" type="text/css" href="boot/css/bootstrap.min.css">
        </head>
        <body>
            <!-- Navigation -->
            <nav class="navbar navbar-inverse navbar-fixed-top" style="background-color:#000066;
            color: white;" >
            <div class="container-fluid">
                <div class="navbar-header">
                    <a class="navbar-brand" href="#" >ZIMDEF</a></div><div>
                    <ul class="nav navbar-nav" >
                        <li ><a href="index.php">Home</a></li></ul>
                </div>
            </div></nav><br>

```

```

<br><br>
    <div class="container" style="margin:0% auto">
        <div class="row">
            <div class="col-md-1"></div>
            <div class="col-md-6" style=" background-color:white; box-shadow: 10px 10px 5px #888888;">
                <div class="row">
                    </div><hr>
                    <div class="row" style="background-color:white; color:Grey;align:center;height:20px">
                        <Center>Accepted and rejected applications will be notified via email
                        account</center></div><hr>
                    <div class="row" style="font-size:16px;">
                </div>
            <div class="col-md-6">
                
            </div>
            <div class="col-md-6" Style="align:center">
                <?php
                    //error_reporting(0);
                    $target_dir = "file/documents/application/";
                    $target_file = $target_dir . basename($_FILES["fileToUpload"]["name"]);
                    $uploadOk = 1;
                    $imageFileType = pathinfo($target_file,PATHINFO_EXTENSION);
                    // Check if image file is a actual image or fake image
                    if(isset($_POST["btn_apply"])) {
                        $code = validate_email($_POST['txt_code']);
                        $phone = validate_email($_POST['txt_phone']);
                        $email = validate_email($_POST['txt_email']);
                        $sm = validate_email($_POST['txt_sm']);
                        $house_id = validate_email($_POST['txt_house_id']);

```

```

    $date_move_in = validate_email($_POST['txt_date_move_in']);
    $optradio = validate_email($_POST['optradio']);

// check if house applied is adequate

// Check file size
if ($_FILES["fileToUpload"]["size"] > 50000000) {
echo "<br><div class='alert alert-warning'>Sorry, your file is too large.</div><br>";
$uploadOk = 0;
}

    // Allow certain file formats
    else if($imageFileType != "pdf" && $imageFileType != "docx") {

    echo "<br><div class='alert alert-warning'>Sorry, Word Document and PDF files are
allowed.</div><br>";

    $uploadOk = 0;
}

else if ($uploadOk == 0) {
echo "<br><div class='alert alert-warning'>Sorry, your file was not uploaded.</div><br>";

// if everything is ok, try to upload file
} else {
$exist = validate_house_exist($house_id);
if($exist == "house_exist")
    {
        # house exist }

    else{
        //echo $exist;

        echo "<br><div class='alert alert-warning'>house does not exist.</div><br>";

        exit();
    }

    $date = date("Y-m-d");
    $security_code = mt_rand(1000,188156093);

```

```

$new_name = $security_code."_". basename($_FILES["fileToUpload"]["name"]);
$new_name = mysqli_real_escape_string($conn,$new_name);
$email = mysqli_real_escape_string($conn,$email);
$phone = mysqli_real_escape_string($conn,$phone);
$code = mysqli_real_escape_string($conn,$code);

# check to see if the code already exist

$sql = "SELECT `id`, `email`, `security_code`, `date`, `used` FROM `tbl_house_apply_code`
WHERE `email`='$email' AND `security_code` = '$code' limit 1";

$result = mysqli_query($conn, $sql);
if (mysqli_num_rows($result) > 0) {
    // output data of each row
    while($row_update = mysqli_fetch_assoc($result)) {
        $code_id = $row_update["id"];
        $used_id= $row_update["used"];
        if($used_id=="yes")
        {
            echo "code already used try again";
            exit();}
        }
    } else {
        echo "it doesn't exist try again";
        exit();
    }

    #check if house space has already been rented
    //echo property_space_decision($house_id,$sm);
    $check_1232 = property_space_decision($house_id,$sm);
    if ($check_1232 === true) {
        # move uploaded details
        if (move_uploaded_file($_FILES["fileToUpload"]["tmp_name"], $target_dir."/".$new_name)) {

```

```

$new_name = mysqli_real_escape_string($conn,$new_name);

$email = mysqli_real_escape_string($conn,$email);

$phone = mysqli_real_escape_string($conn,$phone);

$code = mysqli_real_escape_string($conn,$code);

$house_id = mysqli_real_escape_string($conn,$house_id);

$optradio = mysqli_real_escape_string($conn,$optradio);

    $sql_insert = "INSERT INTO
    `tbl_applications`(`applicant_full_name_company`, `property_id`,
    `square_meters`, `applicant_email`, `applicant_url`, `application_date_applied`,
    `application_start_rent`, `application_status`, `applicant_phone`)

    VALUE('$optradio','$house_id','$sm','$email','$new_name
   ','$date','$date_move_in','pending','$phone)";

</body>

</html>

<?php

$servername = "localhost";

$username_connection = "root";

$password_connection = "";

$database_connection = "db_collen";

// Create connection

$conn = mysqli_connect($servername, $username_connection,
$password_connection, $database_connection);

// Check connection

if (!$conn) {

    die("Connection failed: " . mysqli_connect_error());

}

# 1 get total cost of everyhting (water,cleaning ,security ,electricity)

function calculate_bill_all($property_id,$date1_m,$date2_m){

global $conn;

$date=date_create("2017-$date1_m-1");

$date1 = date_format($date,"Y-m-d");

```



```

$date_ =date_create("2017-$date1_m-$date2_m");
$date2 = date_format($date_,"Y-m-d");

$total_cost = "0";

$date1 = mysqli_real_escape_string($conn,$date1);
$date2 = mysqli_real_escape_string($conn,$date2);

$sqlCheck = "SELECT SUM(`amount`) As s FROM `tbl_bills` WHERE `property_id`
=$property_id' AND `year` BETWEEN '$date1' AND '$date2' GROUP BY
`property_id";

$resultCheck = mysqli_query($conn, $sqlCheck);

if (mysqli_num_rows($resultCheck) > 0) {
    while($row = mysqli_fetch_assoc($resultCheck)) {
        $total_cost = $row["s"];
    }
}

return $total_cost;
}

```

2 get rented area square meters, property id , date started and date ended for that tenant

```

function calculate_bill_transaction($transaction_id){
    global $conn;

    $transaction_id = mysqli_real_escape_string($conn,$transaction_id);

    $sqlCheck = "SELECT `transaction_id`, `property_id`, `date_started`, `date_ended`, `tenant_id`,
    `square_meters` FROM `tbl_transactions` WHERE `transaction_id`=$transaction_id";

    $resultCheck = mysqli_query($conn, $sqlCheck);

    if (mysqli_num_rows($resultCheck) > 0) {
        while($row = mysqli_fetch_assoc($resultCheck)) {
            $date_start["property_id"] = $row["property_id"];
            $date_start["square_meters"] = $row["square_meters"];
            $date_start["date_started"] = $row["date_started"];
            $date_start["date_ended"] = $row["date_ended"];

            if($date_start["date_ended"] == null){

```

```

$date_start["date_ended"] = date("Y-m-d");}

    }return $date_start;

    }else{

    return false;}

    }

# 3 get rented area square meters, property id , date started and date ended for that tenant
function get_square_meters_property($property_id){

global $conn;

$square_meter = 1;

$property_id = mysqli_real_escape_string($conn,$property_id);

    $sqlCheck = "SELECT `property_square_meter` FROM `tbl_properties`
    WHERE `property_id`='$property_id'";

    $resultCheck = mysqli_query($conn, $sqlCheck);

    if (mysqli_num_rows($resultCheck) > 0) {

    while($row = mysqli_fetch_assoc($resultCheck)) {

    $square_meter = $row["property_square_meter"];

    }

    return $square_meter;

    }else{

    return false;

    }

    }

# 4 get personal bill

function get_total_sqaure_meters_rented($property_id){

global $conn;

$property_id = mysqli_real_escape_string($conn,$property_id);

    $sqlCheck = "SELECT SUM(`square_meters`) as s FROM `tbl_transactions` WHERE
    `property_id`='$property_id' AND `date_ended` IS NULL";

    $resultCheck = mysqli_query($conn, $sqlCheck);

```

```

        if (mysqli_num_rows($resultCheck) > 0) {
            while($row = mysqli_fetch_assoc($resultCheck)) {
                $square_meter = $row["s"];
            }
        }

return $square_meter;
    }else{
return 1;
    }
}

# 5 calculate bill for transaction

function cal_bill($transaction1,$mon1,$mon2){
    $check = calculate_bill_transaction($transaction1);
    $total_space = get_square_meters_property($check['property_id']);
    $total_rented = get_total_sqaure_meters_rented($check['property_id']);
    $my_space = $check['square_meters'];
    $total_bill = calculate_bill_all($check['property_id'],$mon1,$mon2);
    $diff = $total_space - $total_rented;
    $my_space_1 = ($my_space / $total_rented)* $diff;
    $my_bill = (($my_space + $my_space_1) / $total_space)* $total_bill;
    return $my_bill;
}

$check5 = cal_bill(0,1,28);

echo "<BR>bill for that date $check5 dd";

?>

```