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DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION SYSTEMS

DINING HALL MANAGEMENT SYSTEM

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ABSTRACT

The purpose of the study was to develop and implement an information system that serves the needs of Chinhoyi University of Technology Dining hall personnel, management and students. For management the system helps in the analysis and provision of information that supports management functions. The research exposed the value and the ability of the organization to undertake the project considering the timeframes and other material resources. With close scrutiny of the findings on how the system operates the developer decided to undertake the project in order to improve efficiency through the use of C#, crystal reports and mysql database server. In the quest to develop a system that is acceptable to the organization, the developer used various information gathering techniques that include questionnaires, interviews and observation in a bid to elicit the challenges the stakeholders had with the manual system. The formulation of basic system functionality of the product to be developed were done through the use of data flow diagrams, entity relationship diagrams for the sake of bringing the conceptual being of the system. Moreover menu; interface; input; and output models were constructed. The logical structures were further turned into specific tested instructions that are to be executed by the computer system. With the following considerations a changeover method was selected which included; risk control, pace of change, and need for facilitation of change. The developer recommends that the users stick to the basics learnt during the training period for any challenges they should refer to the comprehensive user manual. Security measures were considered through use of user names and passwords thus restricting access to certain privileges to some users. To cater for changes in user requirements system maintenance will be provided when the need arise.

DECLARATION

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

Signature _____ Date _____

APPROVAL

This dissertation entitled “**Dining hall system**” by **Chikondowa Tinevimbo** 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 literal presentation.

Supervisor

Date

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DEDICATION

I would like to dedicate this project to my friends and family for encouraging me to keep on working hard. Lastly but not least I would like to dedicate this project to the almighty for keeping me strong throughout.

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List of Acronyms

CUT – Chinhoyi University of Technology

DH- Dining hall system

Chapter 1

1.1 Introduction

The author of this document intends to develop a Dining Hall system hereafter called DH system for Chinhoyi University of Technology hereafter called CUT, that will see CUT students begin using plastic money (student identity cards) to have access to dining hall meals. CUT has been lagging behind in the technology era of the use of plastic money. This synopsis provides with the background of the study and CUT's background information, the aims and objectives of carrying out this project, stating the instruments that will be used to implement the new system and also providing a justification of the system.

1.2 Background of the study

At the moment CUT is using a till system in their dining halls and the process involves students paying for their food in the dining hall. At the end of each day the cashier banks the total funds receipted to the chief teller, the chief teller in turn then banks all the funds that will have been handed to him by all tellers to the accounts office the following day. On a busy day the dining can realize total sales revenue of above 4000 us dollars.

1.2.1 Background of Organisation

Chinhoyi University of Technology was established as part of the recommendations of the Chetsanga Commission to devolve Chinhoyi Technical Teachers' College and other similar colleges into degree – awarding institutions following the realization that technology is the key driver and central cog to industrial development and economic prosperity in Zimbabwe. The University started operating under the auspices of the University of Zimbabwe, in 1999 in what was then called the University of Zimbabwe Chinhoyi Degree Programmed which offered two degrees; Production Engineering and Hospitality and Tourism. This led to the awarding of the Charter to operate as a fully fledged University, through the Chinhoyi University of Technology Act No. 15 of 2001; Chapter 25:23.

At the helm was Professor C.M Herrera as the founding Vice-Chancellor. He immediately set off to do a sterling job to lay a solid foundation by establishing systems which have stood the test of time to this date.

1.2.2 Organizational Structure

At the helm of the institution is a vice chancellor who is deputized by a pro vice chancellor and the chief administration team is comprised of a registrar, bursar and a librarian. Senior management personnel include deans of schools and head of various administration functions that include Information Technology, Marketing etc. Middle management is comprised of various departmental chairpersons from different schools and sectional heads.

1.2.3 Organogram

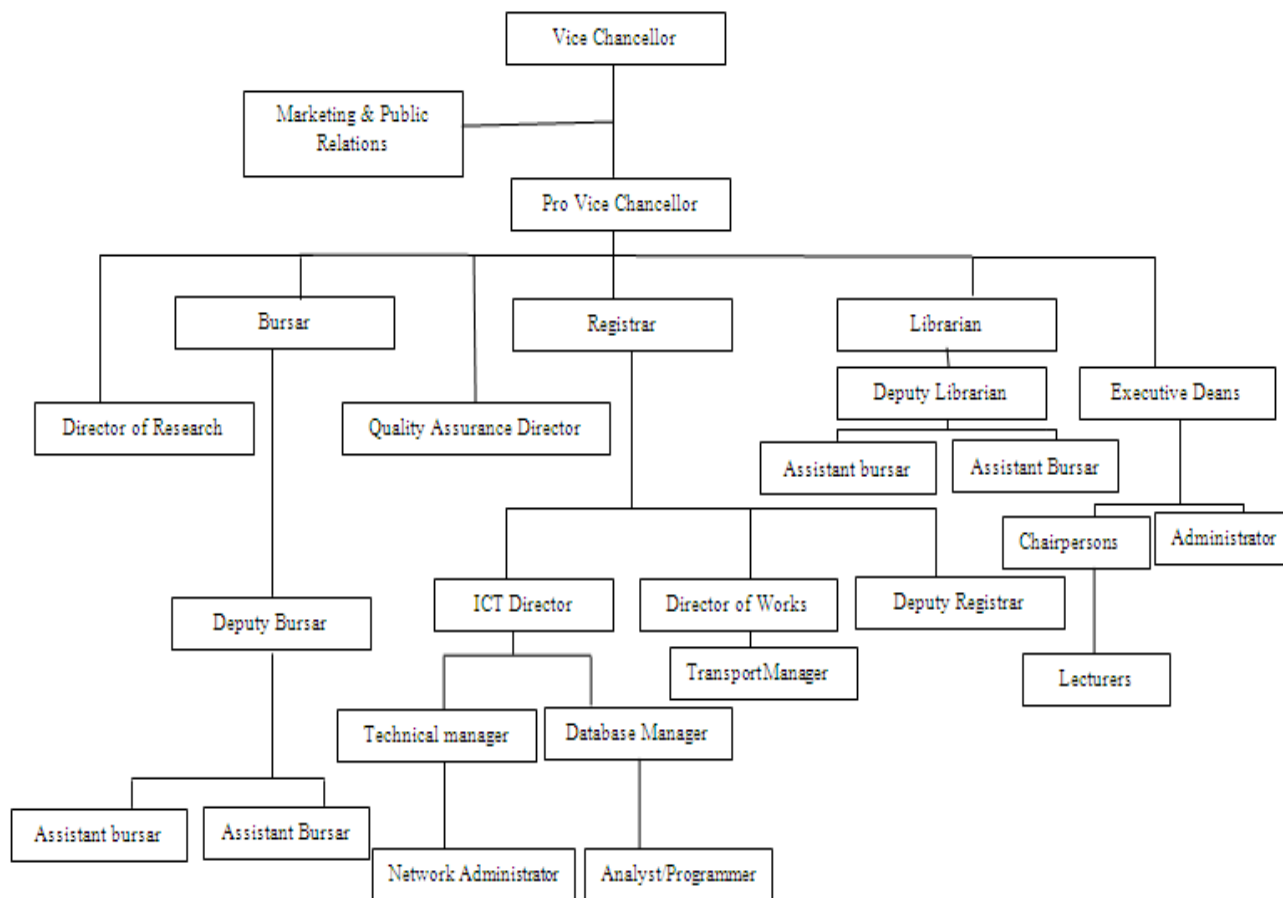


Fig 1.1 Organisational structure

1.2.4 Vision

“To be the world-class centre of excellence for technological innovation and entrepreneurship”

1.2.5 Mission Statement

“To produce innovative graduates, create knowledge, enhance entrepreneurship and provide community service through quality teaching, training and technologically oriented research”

1.3 Problem definition

Misa (2014) reported that the bank noted that change has been a huge problem in the payment system as multi-currencies are not printed locally.

Long queues in the dining hall at CUT is the order of the day during meal times, of which at times these long queues results in different chaotic situations where students yell at each other and noise. These long queues are caused by prolonged waiting time at till points due to change problems, the receipting teller has to check if the notes tendered are genuine money at the expense of the student busy learning schedule.

Strenuous when retrieving information pertaining to sales history as the process is time consuming because one has to go through the sales sheet files document by document and by this delay in decision making will result and also it is prone to errors as it involves human input. Handling of large sums of money poses a security threat to the organization. On a busy day the dining can realize sales revenue of more than 5000 us.

The proposed system seeks to mitigate the above challenges by providing vast convenience to the student and personnel in the dining hall. The problem of change will be eradicated as they will be no need for students to carry cash with them. The use of the new system will solve the problem of retrieval of past records and also fosters decision making process by generation of reports hence adding value to CUT.

1.4 Aim of the study

This research aims to:

- (i) Develop a computerized DH system that would allow students to use their identity cards to top up their DH meal accounts and have access to meals in the dining hall.

1.5 Objectives of the study

According to Tulsian (2007) objectives are desired end results of an activity which one attempts to achieve. They act as a translation of an organisation's mission into concrete terms against which results can be measured.

The proposed system seeks to achieve the following objectives:

- ✓ To allow students to top up their DH meal accounts.
- ✓ To allow students to buy meals using their student identity cards.
- ✓ To generate adhoc student DH meal accounts statements.
- ✓ To generate adhoc DH sales revenue for a specified period.
- ✓ To allow an audit trail of activities performed by users.

1.6 Hypothesis

The current challenges being faced at CUT in their dining hall whilst using the traditional till system will be a thing of the past once the new computerized database driven DH system is deployed and implemented. The new system will bring business value to the institution, enables fast processing and efficiency. Below are tools used in coming up with the system.

- ✓ Mysql (database server)
- ✓ Windows.Net 3.5 (windows development framework)
- ✓ Crystal reports(Reporting tool)
- ✓ Microsoft Visual C#(Programming language)

1.7 Justification of the study

The DH system is a solution to the current problems as any or all sales activity will be recorded and not only does that mean timely and accurate sales tracking, but the DH system also lets you generate adhoc sales reports for informed and enhanced decision making process. The new system will be welcomed by students as it will bring a great deal of convenience as they will be no need of moving around with cash at the same eradicating the change problem.

The DH system will go a long way in alleviating the challenges faced by the current system and also improvement of service delivery.

1.8 Conclusion

This chapter has spelled out the current the challenges being faced by the current till system and how it is detrimental to CUT as far as service delivery in the dining hall is concerned. The objectives were clearly outlined of the new system and how the new system intends to bring business value to CUT. However the next stage is the planning stage as the author seeks to come up with a detailed development plan of the new system.

Chapter 2: Planning phase

2.1 Introduction

Planning is key to any software development project success, being the second phase in the software development life cycle, it provides basis for performing and managing the software project's activities and addresses the commitments to the software project's consumer according to the resources, constraints, and capabilities of the software project. Kotler (1998) states that planning is basically concerned with what are we going to do and how are we going to do it? The planning phase encompasses formulation of activities that help guide through the execution, monitoring and beginning, closure of phases within a project development cycle. Planning will so aid in the management of resources that include financial, technical, personnel the system requirement requires and is not only limited to that but also in the management of time, cost and risk. With the quest of coming up with the right product with resources available the author of this document will also take you through the following:

- feasibility analysis(technical, operational, economic).
- return on investment.
- project scheduling(gantt charts, deliverables and milestones)

2.2 Why build the system?

The core aim of building the system is to provide a solution that will meet user expectations and also bring notable efficiency in the operations and running of CUT DH system with the main mandate of minimising service time when one enters the DH for meals.

2.3 Business Value

According to Michele and Stacia (2008) business value is an informal term that includes possible gains that can be derived for the well-being of a firm in the long run.

Business value expands concept of value of the firm beyond economic value.

The new system should be of great significance in order for it to make an impact, However this section seeks to identify the business value of the proposed system to the organisation.

If the system is implemented the following are business value to the organisation:

- ✓ enhances decision making process
ad hoc generation of various reports e.g. in respect of sales and payments made will be retrievable swiftly.

- ✓ Minimum supervision
Control can be maintained in absencia.
- ✓ Increased customer service time
Students will enjoy reduced waiting time for meals.
- ✓ Reduction in operational costs
Less stationery will be required for operational processes.

2.4 Feasibility Study Analysis

Sommer (2011) explains feasibility study as a process used to determine whether the identified user needs may be satisfied using current software and hardware technologies.

According to Kendall (2008) , there are three types of feasibility, namely; Technical, Economic and Operational. The main goal of feasibility study is not to solve the problem but to achieve the scope. However in carrying out the feasibility study the following feasibility study types were employed:

- ✓ Technical feasibility
- ✓ Operational feasibility
- ✓ Economic feasibility

2.4.1 Technical Feasibility

The thrust of this technical feasibility is to gain an appreciation of the present technical resources of CUT and their applicability to the expected needs of the new system.

However the need to evaluate the system given the resource and time constraints is of paramount importance. In-depth introspection of CUT's current infrastructure that may be of use to the new system showed that the institution has more than sufficient infrastructure needed for the successful implementation of the project.

The following areas were explored:

- ✓ Technical expertise
CUT is privileged to have highly qualified Information Technology technocrats who can support and train users on the use of the system.
- ✓ Computer resources
The institution can easily purchase computers to use for the system and already in place is local area network and servers hence providing a ready platform for the implementation of the new system.

Hardware Requirements

- ✓ 4 Desktop computers.

- ✓ 3 thermal printers (point of sale printers).
- ✓ 1 LaserJet printer.
- ✓ 3 rfid readers.

Software Requirements

- ✓ Operating Systems minimum Windows XP.
- ✓ MySql.
- ✓ Windows.Net frame work version 3.5.
- ✓ Mysql ODBC Driver.

2.4.2 Economic Feasibility

Economic feasibility encompasses identification of financial risks, costs and benefits associated with the new system. According to Kendall and Kendal (2008), economic feasibility determines whether the time and money are available to develop the system.

Dennis, Wixom and Roth (2009) explain that feasibility analysis is aimed at performing an economic benefit analysis which is also called a cost–benefit analysis. In carrying out feasibility study the following were considered:

- ✓ Operational costs
- ✓ Development costs
- ✓ Cost benefit analysis
- ✓ Return on investment

2.4.2.1 Operational Costs

Dennis et al (2009) defines operational costs as those tangible costs that are required to operate the system. Operational costs are also known as ongoing costs and are met as long as the business is operating. Below is a table that shows operational costs expected from the new system.

Description	Quantity	Unit Cost (Us\$)	Total Cost(Us\$)
✓ bond paper reams	5	4	7
✓ till rolls	20	2.5	50
✓ cartridges	4	60	240
Total Cost			297

Table 2.1 operational costs

2.4.2.2 Development Costs

Development costs are expenses incurred during the software development process of the system that include salaries for the development team, fuel, hardware and software expenses. Development costs are usually thought of as one-time costs explain Dennis, Wixom and Roth (2009).

The following table shows the development costs.

Description	Cost us\$
✓ Salaries	-
✓ Overtime	750
✓ Fuel/transport	120
✓ Hardware	-
✓ Software	-
Total costs	870

Table 2.2 Development Costs

2.4.3 Cost Benefit Analysis

Lucey (1996) defines cost benefit analysis as the comparing of benefits and cost so as to make a decision based on that comparison. A cost benefit analysis helps to discern whether a project is feasible to implement that is if the benefits surpass the cost of the project. The table below is a projection of the cost and benefit analysis.

	Us\$	Us\$
Benefits		
Customer service satisfaction		1 000.00
Increase in sales revenue		10 000.00
Operational cost reduction		500.00

Human error reduction		6000.00
Gross benefits expected benefits		17500.00
Less Costs		
Development Costs	870.00	
Operational Costs	297.00	
Initial Hardware Cost	4000.00	
Initial Software Cost	600.00	(5767.00)
Net Benefits		11733.00

2.4.4 Return on Investment Analysis (ROI)

According to Dennis et al (2009), ROI is defined as The return on investment (ROI) is a calculation that measures the average rate of return earned on the money invested in the project. A high ROI suggests that the project's benefits far outweigh the project's cost. ROI is a simple calculation that divides the project's net benefits. The formulae are as follows:

$$\text{ROI} = \frac{(\text{Total Benefits} - \text{Total Costs})}{\text{Useful life(years)}}$$

$$= \frac{(17\ 500 - 5767)}{3}$$

$$3$$

$$\text{Net benefit} = \underline{3911}$$

$$= \frac{\text{Net benefit} * 100\%}{\text{Total investment}}$$

$$\text{Total investment}$$

$$= \frac{3911 * 100\%}{5767}$$

$$5767$$

$$= \underline{\underline{67.81\%}}$$

Regardless of the fact that this method ignores the value of money, the project proved to be economically viable.

2.4.5 Operational Feasibility

Operational feasibility's core objective is to ascertain whether the proposed system will meet user expectations and is not only limited to that but also the willingness and acceptance by the users

and management to use the system. To achieve this an assessment should be carried out of the new and current system.

Kendall and Kendall (2002) describes operational feasibility as dependent on personnel who will use the system. For the system to be deployed system users should have accepted it for it to be operationally feasible. From interviews carried out and various information gathering techniques used to gather data the general consensus thus far the realisation has been that basically all the staff members including management are craving to adapt the new proposed system. On analysis the writer ascertained that the system is operationally feasible because it has been established that:

- ✓ System users have the desired computer skills and the expected level of computer literacy for them to learn and use the DH system.
- ✓ One of the system goals is to produce adhoc reports on sales hence saving time and also steering the decision making process with this feature and many other features that of convenience to the user and management, it is very are likely to accepted.
- ✓ Only a few new technological infrastructure is needed to be purchased as most of it is already there.

2.5 Risk Analysis

According to McGraw (2008) Risk analysis is often viewed as a “black art” part fortune telling, part mathematics. Risk analysis is however more than a business level decision support tool as it’s a way of gathering the requisite data to make a good judgment call based on every project involves a degree of risk that may affect the desired outcome of the system. In recognition of that, there is a necessity to identify the risks, monitor and develop risk mitigation plans. All this is done so as to reduce the impact of the risk, which will save costs of rectifying the situation when it occurs.

2.5.1 Technical risks

- ✓ System users might find it burdensome to maintain the system or restore it in the event of a system failure. Regular database back up should be done so as to establish a fallback position in the event of a system failure.
- ✓ Power cuts – surge protectors and use of a generator as a backup power source.

2.5.2 Risk management

- ✓ DH system resides on a windows platform which is prone to viral attacks.

To counter this all computers shall have Anti-virus software installed and configured for automatic regular updates.

- ✓ Project Sponsors risks - There could be a risk that the project sponsor would decide not to fund the project before completion. Thus there is a need to be well prepared for that eventuality.
- ✓ System may not meet the user’s expectations. To mitigate this risk the developer will continuous engage the users through the development and maintenance stages of the product life cycle.
- ✓

2.6 Project Schedule

Once a project manager has a general idea of the size and approximate schedule for the project, he or she creates a work plan also known as a Gantt chart. This is a dynamic schedule that records and keeps track of all of the tasks that need to be accomplished over the course of the project. The project manager first must assemble important details about each task to be completed. Dennis, Wixom and Roth (2009).

2.6.1 Workplan

A work plan is guide line that shows project activities timelines. Below is a work plan for the proposed system.

Phase	Duration	Start Date	End Date
Project Proposal	1 week	07-07-2014	14-07-2014
Planning	1 week	04-08-2014	11-08-2014
Analysis phase	1 week	12-08-2013	19-08-2014
Design	2 weeks	20-08-2014	10-09-2014
Implementation and maintenance	3 weeks	11-09-2014	02-10-2014
Final documentation	1 week	03-10-2013	10-10-2014

Table 2.8 Work Plan

2.6.2 Gantt Chart

It is a pictorial representation of the project schedule that shows duration of the stages in the development of the project this is also displayed in the work plan show case of management. It enables management team to clearly track down the progress of the project.

Table 2.9 Gantt Chart

WEEK	1	2	3	4	5	6	7	8	9
PROJECT PROPOSAL									
PLANNING									
ANALYSIS									
DESIGN									
TESTING									
IMPLEMENTATION & MAINTENANCE									
DOCUMENTATION									

Fig 2.1 gantt chart

2.7 Conclusion

The author concludes that the system’s planning phase progressed successfully as the feasibility study, risk assessment proved the project to be worthwhile embarking and a progress review chart has been constructed. In the next chapter, the analysis phase, the analyst provided details of the succeeding phase where the existing system is analyzed in detail in terms of its processes and data flows and also the proposed system processes and data flows been reflected.

Chapter 3: Analysis phase

3.1 Introduction

According to Godfrey (1999), system analysis is a process of inspecting, cleaning, transforming and modeling data with the goal of highlighting useful information. Analysis also involves a survey of the problems associated with the current system. Analysis stage of a software development is considered to be one of the most crucial phases in the systems development life cycle (SDLC). The information (input and output) and processes of the current system will be under scrutiny, in this chapter the author will unearth the current users of the system, what data, how and where the data is being handled in the current system through the use of different gathering techniques employed.

The mandate of this phase is to establish the following:

- ✓ more details pertaining to the current system functionality as far as processes are concerned.
- ✓ outline problems of the current system
- ✓ state requirements and limitations of the present system
- ✓ what to expect from the new system
- ✓ evaluation of possible alternatives and identifying the best solution.

3.2 Information gathering methodologies

The following information gathering techniques were employed:

- ✓ Interviews
- ✓ Observation
- ✓ Questionnaires

3.2.1 Interviews

Interviews were conducted in the analysis of the existing system and finding user requirements between the users and developer. Interview is a conversation between two people (the interviewer and the interviewee) where planned set of questions are asked by the interviewer to elicit information about the certain topic Kvale (1996)

Below are the steps taken by the author in carrying out the interviews:

- ✓ Selection of interviewees
- ✓ Designing interview questions.
- ✓ Carrying out the interviews.

The author selected the interviewees who were able and willing to give the information that was required to understand the current system. The interview questions were designed in a way that would allow one to get as much information as possible from the interviewee (open ended questions). After using interviews as an information gathering methodology, the author managed to note the advantages and disadvantages of using this method.

Advantage of interviews

- Interviews allow direct communication with the people who manage and operate current system. Thus, one can get a first-hand understanding of: how the system operates, the existing problems and opportunities to improve performance.
- It helps to get practical thoughts from sampled individuals.
- It helps in the enlightening of some the areas that were not understood by the researcher.
- Are very private and confidential.
- It is very direct and the response rate is immediate.
- Interpersonal interaction.

The disadvantages of interview

- It can produce over reliance and or hearsay.
- The interviewer may hear what he/she wants to hear.
- Stereotyping of interviewee can influence what are the interviewers' facts.
- The information gained should be verified from other resources.
- The interviews are time consuming.

Results from Interviews

From the interviews carried out the author the till supervisor showed disgruntlement on the current manual system that requires a lot of work especially when preparing sales activity reports. The till operators are content with the current system.

3.2.2 Observations

According to Brown (2000) the Observation method of research is basically developed for observing people in their natural setting. It focuses more on their everyday normal life there are two types of Observation methods:

- Non-Participant observation
- Participant Observation

Advantages

- It helps in overcoming issues of validity and bias.
- It is useful when the subject cannot provide information.
- It is also useful when the subject is feared to provide inaccurate information.

Disadvantages

- Past events being studied
- Frequently measuring attitudes or opinions
- Selecting a sample is tricky
- Time and costs are high - can be automated

Results from Observation

The writer observed that change can be a problem as customers will have to wait more than anticipated and this challenge will result in some chaotic long queues at the expense of the customer's busy learning schedule.

3.2.3 Questionnaires

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents(Gillham, 2008). A set of questions were designed on paper, which were answered by the Registrar, lectures and students. The responses were sufficient to fulfill the analysis. The lecturers and students pointed out the problems they were encountering with the scheduled time slots to the lecture rooms and venues.

Advantages

Gillham (2008) gives the following advantages:

- Allows you to get an overview of the business processes.
- The respondents had time to consider their responses before writing them down.
- It provides reliable data for the author.
- Respondents answer the questionnaires more openly expressing their views since they were made to be anonymous.
- It is cost effective and saves much needed time, since the questionnaires are distributed at once to various people.

Disadvantages

Gillham (2008) gives the following advantages:

- Usually costly and takes time to collect and analyze. The data can also be skewed, depending on the target audience for which the questionnaire actually gets completed by.
- There is lack of personal communication between the researcher and the respondent.
- Pre coded answers can be frustrating for respondent thus deterring them from answering.
- Pre coded answers are biased.
- Incomplete or poorly complete answers may be provided.
- They are impersonal, intrusive and time consuming.

- Some questions are answered wrongly because they have been misinterpreted, and some are left unanswered because they seem ambiguous to the respondent.
- Some of the questions were answered wrongly because they had been misinterpreted or some were left unanswered because they seemed ambiguous to the respondent.

Findings from Questionnaires

The following were findings from questionnaires:

- ✓ Preparing of reports is a challenge.
- ✓ Manual system is inefficient as far as time management is concern

3.3 Analysis of existing system

At this stage the author gives a details of how the current system operates.

3.3.1Description of current system

CUT dining hall serves three meals a day which are breakfast lunch and supper. Currently a till system is being used at CUT in their dining hall and the following are the main people involved in a normal day of operation:

- ✓ Customer(student or staff member)
- ✓ Till operator
- ✓ Canteen supervisor

Below is how each of above people are involved in the day to day activities of the dining hall:

✓ Customer

Customer walks in the dining hall and join a queue. Upon reaching till point the Customer makes a payment and is issued a receipt which they produce to the DH personnel who is responsible for serving meals and served with their meal choice.

✓ Till operator

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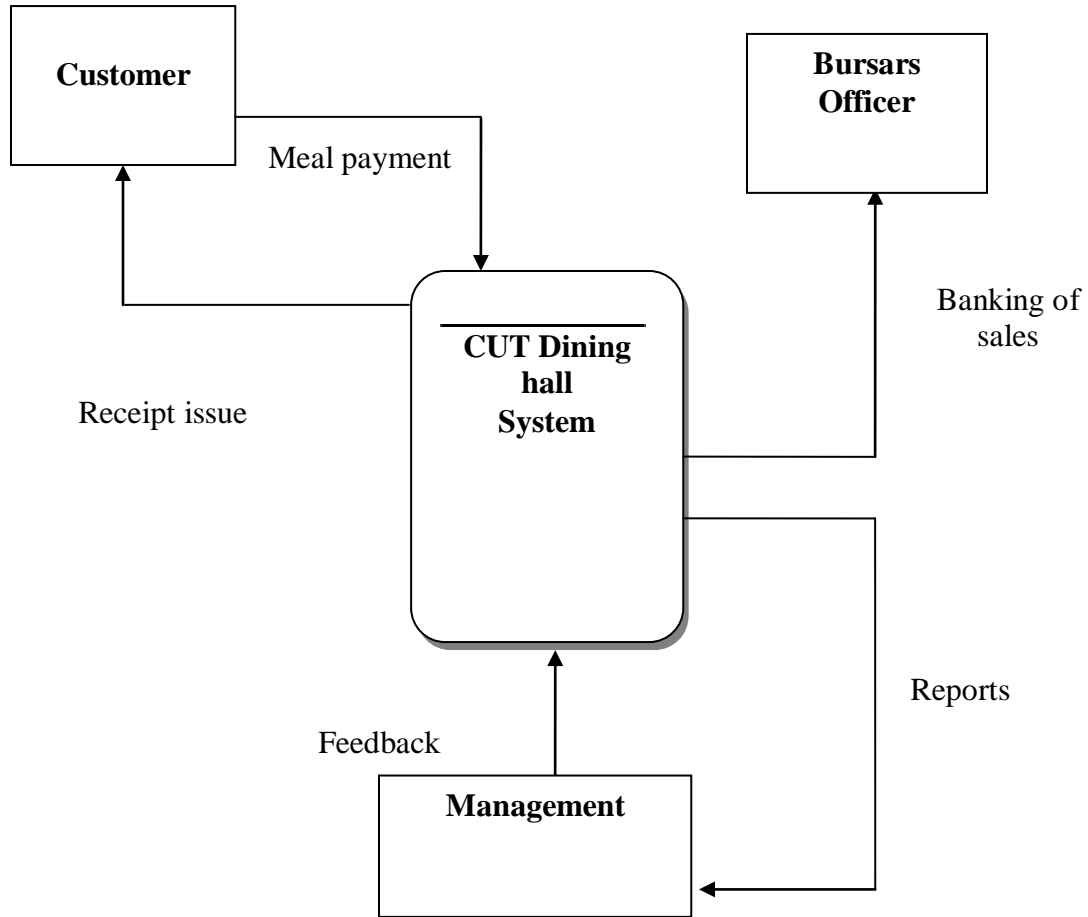


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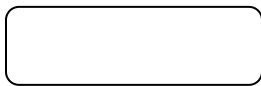
Key



Entity



Data flow



Process

3.4.2 Data Flow diagram

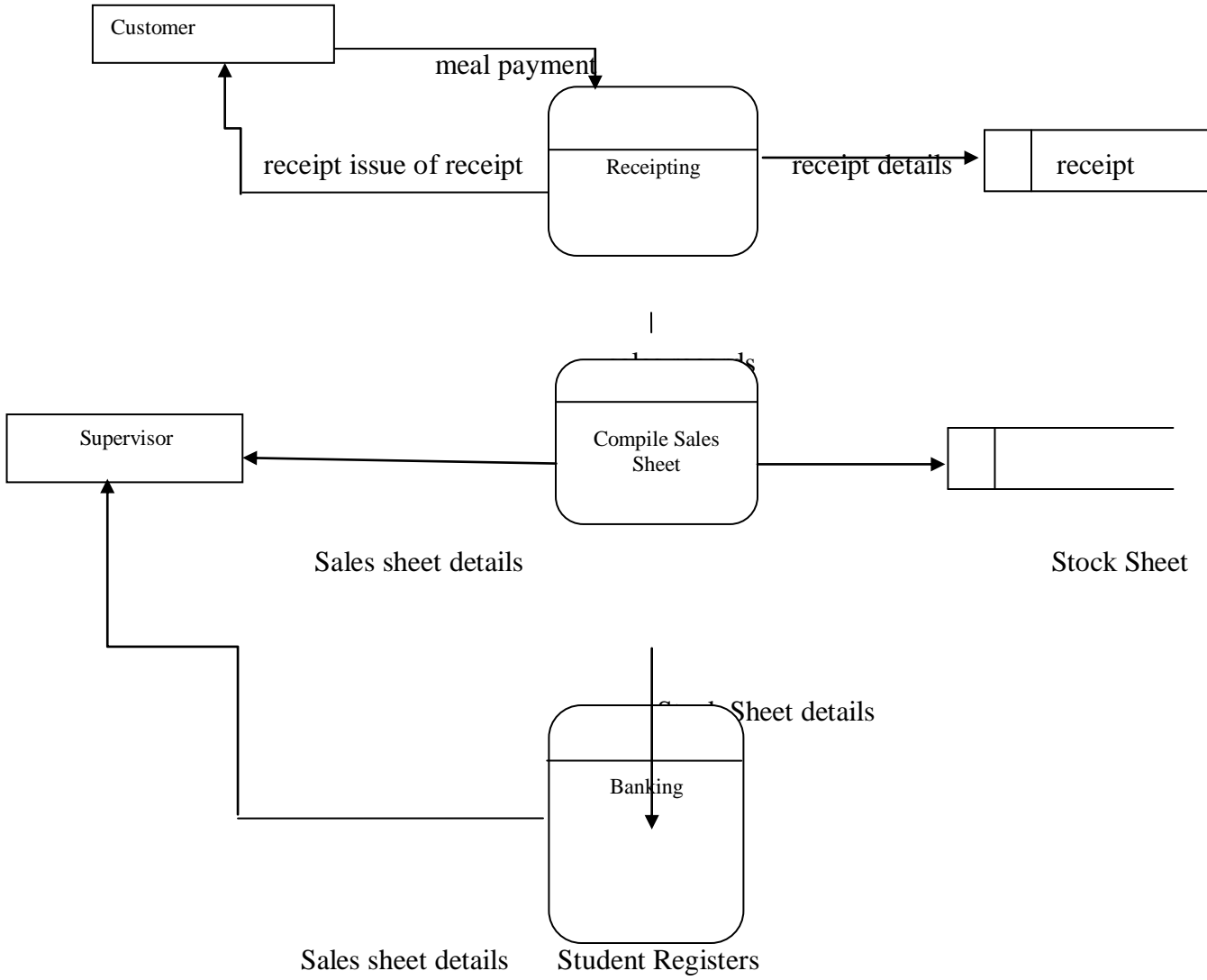
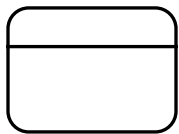
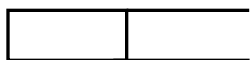


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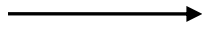
Process



Data store



Entity



Data flow

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- ✓ Improvement
- ✓ In house development

The above will further be discussed respectively.

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Advantages

The following advantages are according to (Krugman, 2009)

- Requires less time to implement.
- Lowers the development cost.
- System improvements can also be done on user request since the users will be paying license and maintenance fees.

Disadvantages

Krugman (2009) gives the following disadvantages

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- Increased training cost as there will be constant reference to the developers.
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Reasons why not accepted

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Advantages

- ✓ It is easy and simple for the employees to use an improved system as there are used to the current system.
- ✓ Development time and costs are reduced if the manual system is simply upgraded

It is easy and simple for the users to use an improved system because fear of the unknown will be eliminated.

Disadvantages

- ✓ A current system is prone to human error hence a continuation of the current problems.
- ✓ The current system is complex and will be difficult to upgrade it hence need of a new system
- ✓ Weaknesses of the current system will tend to resurface in the long run hence it will be a short term solution.

Reasons why not accepted

Although the current system has the capability of accommodating changes and upgrades, it might be a big challenge since the system is a heavily financed package and therefore diverting it might cause complications and a lot of development time will be needed. Also Weaknesses of the current system will tend to resurface in the long run hence it will be a short term solution.

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In house development is where the system is built by the internal programmers of the organization Krugman, 2009. Developing a system has a huge initial capital but benefits realized in the long run make this cost acceptable. By adopting this approach to develop the computerized system, the following merits will be realized:

Advantages

- ✓ **System Ownership:** - system users assume complete ownership of the system as system specifications are based on user requirements during system development.
- ✓ **Employee development:** - although in house development is challenging, the university will continue to build its employee skill base through in house development and training of staff.
- ✓ **Easy to maintenance** will be simple since the system will be a product of Arrupe university 's IT department.

Disadvantages

- ✓ Custom development is time consuming.
- ✓ A custom developed system poses a threat of huge loss of money if the system fails to meet stated objectives.

- ✓ Probability of overstating and under estimating budgets by the management and developers, and thus trustworthy is one of the major constraints in software development amongst the core parties involved.

Reasons for acceptance

In house development was accepted because it can solve unique user requirements as users will be involved in the development of the system and contribute what they require. Also it is less expensive to implement this strategy since the development team will be part of the company’s workforce.

3.6.4 Alternative selection

However, given the general advantages attached to the other alternatives with those of developing an in-house system better weighing. The main benefit of developing the system in-house was the potential to satisfy the unique user requirements and reduce vendor dependency since the developers were internal. The in-house development alternative was chosen since this ensures that:

- ✓ Upgrades were done internally whenever the need arises since people who were providing the support were readily available.
- ✓ All the user requirements and specifications were incorporated into the system.
- ✓ Cost- It is very cost effective to develop an own internal system as the costs are shown in the table below:

Cost summary of alternatives

Alternatives	Cost (us \$)
In house development	3150

Outsourcing	5000
Improvement	2500

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3.7 Requirements Analysis

A requirement analysis is an analysis of what the system should do and its desirable properties.

These are divided into two:

- Functional requirements -those that describe system services or functions
- Non-functional requirements -support functional and impose constraints.

3.7.1 Functional Requirements

The system will be expected to perform to a certain level which will form part of the functional requirements and these will consists of various inputs, processes and outputs that are expected of the system. Below are functional requirements for the system:

System should allow:

- ✓ Allow students to top up their DH meal accounts.
- ✓ Allow students to buy meals using their student identity cards.
- ✓ Generate adhoc student DH meal accounts statements.
- ✓ Generate adhoc DH sales revenue for a specified period.
- ✓ Allow an audit trail of activities performed by users.

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- Security – Use of stringent passwords and different view levels to control access to data to reduce electronic fraudulent activities and unauthorized access to data.
- Hardware Consideration – The users of the system which include students and the college staff at any stage, should have personal computers or access to college computers and must have at least 800 MHz of processing speed, 256 Mb of memory and 80 gig hard drives to facilitate fast communication and sharing of information.
- System Interfacing – The system should be highly interactive and user friendly in order for the users to able to work with the system and easy access.
- Back up – the database system should be backed-up continuously at least once every four hours in order to minimize data loss in the case of a catastrophic failure. The system

administrator should maintain the system and its databases to ensure integrity and availability of information.

3.8 Conclusion

After having collected enough information using questionnaires, interviews, observation and sampling to analyse the existing system it has been considered appropriate to implement the development of the system through the development of a unique software package which will be the most ideal solution for the problem, as a result all the functional and non-functional requirements have been identified.

Chapter 3: Analysis phase

3.1 Introduction

According to Godfrey (1999), system analysis is a process of inspecting, cleaning, transforming and modeling data with the goal of highlighting useful information. Analysis also involves a survey of the problems associated with the current system. Analysis stage of a software development is considered to be one of the most crucial phases in the systems development life cycle (SDLC). The information (input and output) and processes of the current system will be under scrutiny, in this chapter the author will unearth the current users of the system, what data, how and where the data is being handled in the current system through the use of different gathering techniques employed. The mandate of this phase is to establish more details pertaining to the current system functionality as far as processes are concerned, outline problems of the current system, state requirements and limitations of the present system, what to expect from the new system and evaluation of possible alternatives and identifying the best solution.

3.2 Information gathering methodologies

The following information gathering techniques were employed:

- ✓ Interviews
- ✓ Observation
- ✓ Questionnaires

3.2.1 Interviews

Interviews were conducted in the analysis of the existing system and finding user requirements between the users and developer. Interview is a conversation between two people (the interviewer and the interviewee) where planned set of questions are asked by the interviewer to elicit information about the certain topic Kvale (1996)

Below are the steps taken by the author in carrying out the interviews:

- ✓ Selection of interviewees
- ✓ Designing interview questions.
- ✓ Carrying out the interviews.

The author selected the interviewees who were able and willing to give the information that was required to understand the current system. The interview questions were designed in a way that would allow one to get as much information as possible from the interviewee (open ended questions). After using interviews as an information gathering methodology, the author managed to note the advantages and disadvantages of using this method.

Advantages of interviews

- Interviews allow direct communication with the people who manage and operate current system. Thus, one can get a first-hand understanding of: how the system operates, the existing problems and opportunities to improve performance.
- It helps to get practical thoughts from sampled individuals.
- It helps in the enlightening of some the areas that were not understood by the researcher.
- Are very private and confidential.
- It is very direct and the response rate is immediate.
- Interpersonal interaction.

The disadvantages of interview

- It can produce over reliance and or hearsay.
- The interviewer may hear what he/she wants to hear.
- Stereotyping of interviewee can influence what are the interviewers' facts.
- The information gained should be verified from other resources.
- The interviews are time consuming.

Results from Interviews

From the interviews carried out the author the till supervisor showed disgruntlement on the current manual system that requires a lot of work especially when preparing sales activity reports. The till operators are content with the current system.

3.2.2 Observations

According to Brown (2000) the Observation method of research is basically developed for observing people in their natural setting. It focuses more on their everyday normal life there are two types of Observation methods:

- Non-Participant observation
- Participant Observation

Advantages

- It helps in overcoming issues of validity and bias.
- It is useful when the subject cannot provide information.
- It is also useful when the subject is feared to provide inaccurate information.

Disadvantages

- Past events being studied
- Frequently measuring attitudes or opinions
- Selecting a sample is tricky
- Time and costs are high - can be automated

Results from Observation

The writer observed that change can be a problem as customers will have to wait more than anticipated and this challenge will result in some chaotic long queues at the expense of the customer's busy learning schedule.

3.2.3 Questionnaires

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents(Gillham, 2008). A set of questions were designed on paper, which were answered by the Registrar, lectures and students. The responses were sufficient to fulfill the analysis. The lecturers and students pointed out the problems they were encountering with the scheduled time slots to the lecture rooms and venues.

Advantages

Gillham (2008) gives the following advantages:

- Allows you to get an overview of the business processes.

- The respondents had time to consider their responses before writing them down.
- It provides reliable data for the author.
- Respondents answer the questionnaires more openly expressing their views since they were made to be anonymous.
- It is cost effective and saves much needed time, since the questionnaires are distributed at once to various people.

Disadvantages

Gillham (2008) gives the following advantages:

- Usually costly and takes time to collect and analyze. The data can also be skewed, depending on the target audience for which the questionnaire actually gets completed by.
- There is lack of personal communication between the researcher and the respondent.
- Pre coded answers can be frustrating for respondent thus deterring them from answering.
- Pre coded answers are biased.
- Incomplete or poorly complete answers may be provided.
- They are impersonal, intrusive and time consuming.
- Some questions are answered wrongly because they have been misinterpreted, and some are left unanswered because they seem ambiguous to the respondent.
- Some of the questions were answered wrongly because they had been misinterpreted or some were left unanswered because they seemed ambiguous to the respondent.

Findings from Questionnaires

The following were findings from questionnaires:

- ✓ Preparing of reports is a challenge.
- ✓ Manual system is inefficient as far as time management is concern

3.3 Analysis of existing system

At this stage the author gives a details of how the current system operates.

3.3.1Description of current system

CUT dining hall serves three meals a day which are breakfast lunch and supper. Currently a till system is being used at CUT in their dining hall and the following are the main people involved in a normal day of operation:

- ✓ Customer(student or staff member)
- ✓ Till operator
- ✓ Canteen supervisor

Below is how each of above people are involved in the day to day activities of the dining hall:

✓ Customer

Customer walks in the dining hall and join a queue. Upon reaching till point the Customer makes a payment and is issued a receipt which they produce to the DH personnel who is responsible for serving meals and served with their meal choice.

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Is responsible for receipting all dining hall customers as they walk in for their meals. The till operator can only receipt customers when a session (can be breakfast, lunch or supper) is opened for them to do so by the supervisor. When a customer makes a payment the operator issues a receipt. At the end of a receipting session, the till operator fills in and signs a sales remittance sheet and submits total sales for the session to the supervisor.

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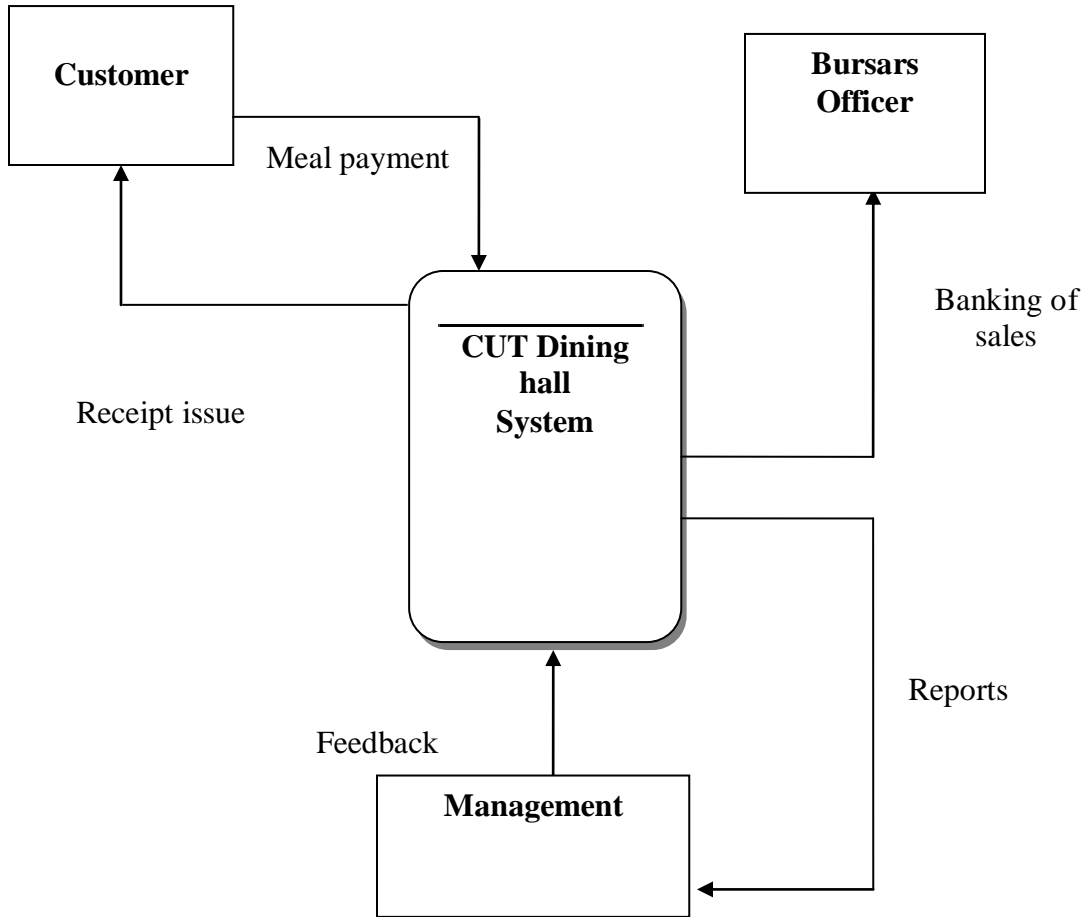


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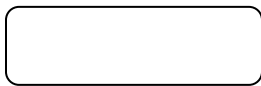
Key



Entity



Data flow



Process

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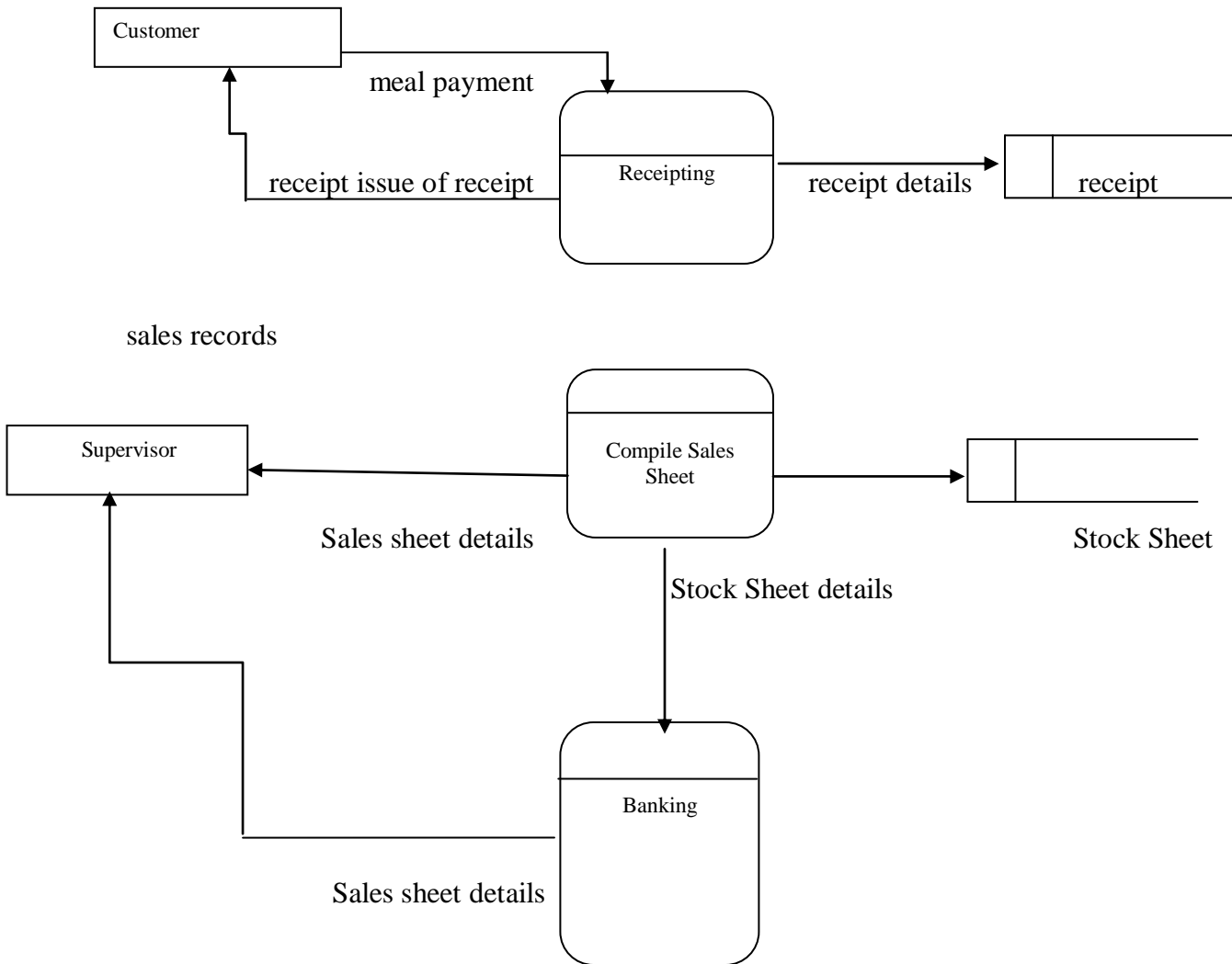
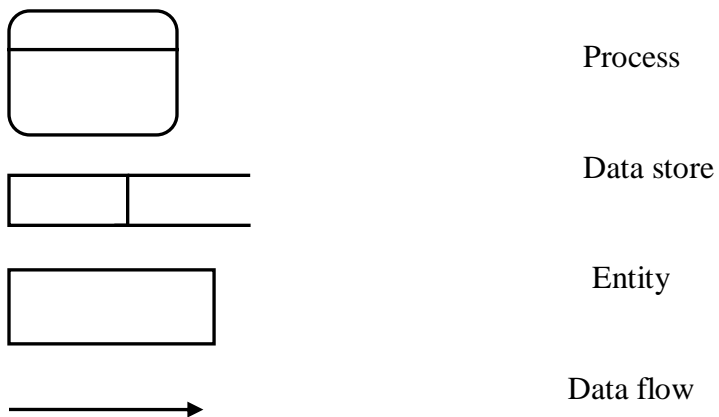


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Chapter 4: Design phase

4.1 Introduction

The design stage 's core agenda is to show how the proposed system is going to be developed, configured and deployed. Generally, design gives an outline of the system architecture, database interface and program structure. Kendall and Kendall (2002), define system design as process of using various methods and principles for the purpose of coming up with a process or a system in regard to its physical realization.

4.2 System Design

Satzinger et al (2002) defines design as the process of defining the architecture, components, modules, interfaces and data for the system to satisfy specified requirements. The core aim of the design stage is to ensure the system is to built a system that is efficient, effective, maintainable and reliable.

- **Effectiveness:** the systems performance must meet the reasons it was designed for.
- **Efficiency** -The system should reduce the amount of time taken to complete all processes.
- **Maintainability:** System must allow additions and modifications of new and current features.
- **Reliability:** system must be consistence in its operations and also it must be always available for use.
- **User friendliness:** System must be used with minimal support and consultation.

4.2.1 Context Diagram

The context diagram for the proposed system is an outline of the system boundaries. The context diagram is the highest level view of a system, like a block diagram it depicts the whole system in regard of the system's inputs and outputs from internal to external factors. To an extent, it reflects the level to which the system interacts with the external environment.

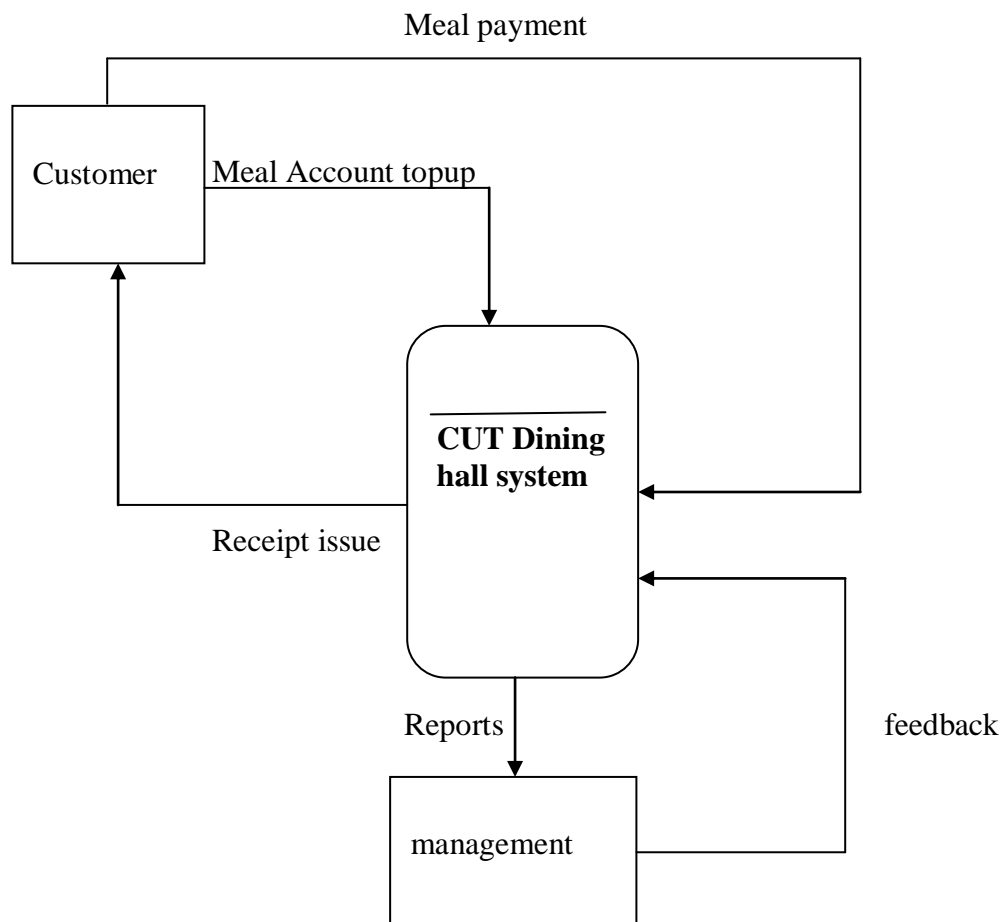
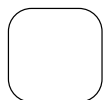
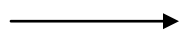


Fig 4.1 Context diagram of proposed system

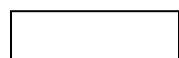
Key:



Process



Data Flow



Entity

Data flow diagram for the proposed system

According to Whitten, et al (2003), Data Flow Diagram (DFD) is a graphical depiction of the system's processes and data flow data between processes. A data flow diagram shows the flow of data to, from and within and the process that transforms the data.

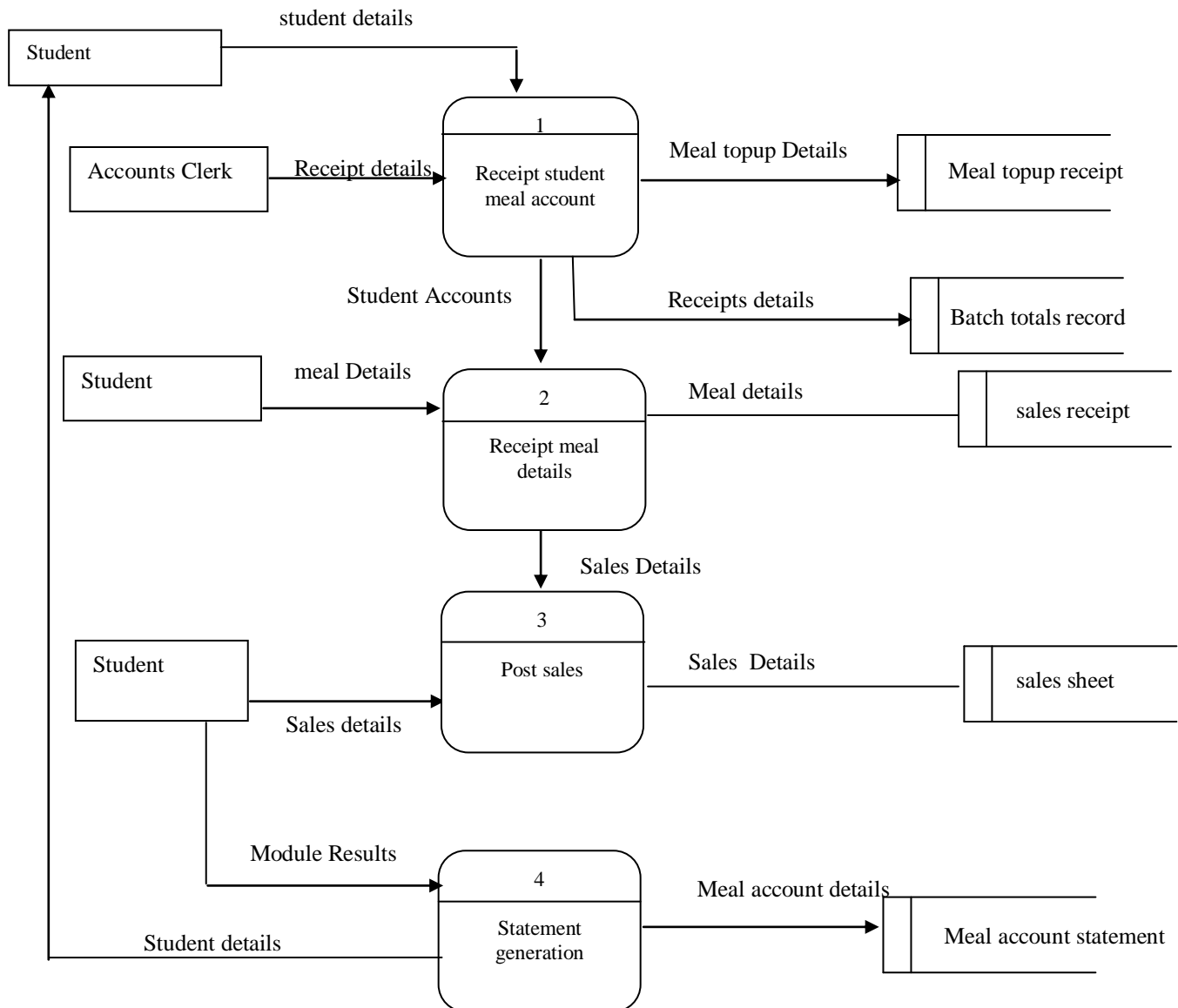
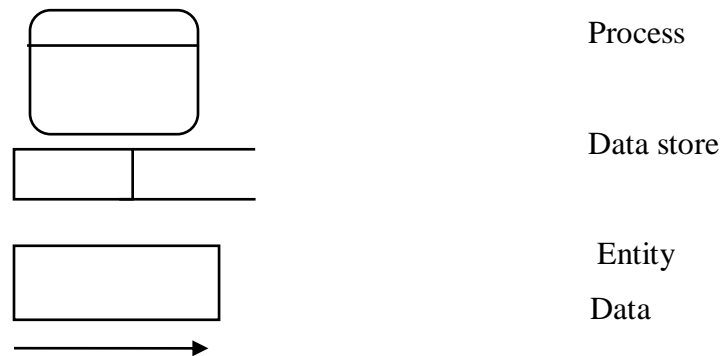


Fig 4.2 Data flow diagram of proposed system

Data Flow Diagram key



4.3 Architectural Design

In this phase the system components are identified including the control and data flow between them. For each of the components, the functions that it should perform are stated including data input and output. The system will be a win 32 application and the architecture will consist of:

- **Client machines** – this is where the Graphical User Interfaced Applications are going to reside. These machines are going to provide the interface for communicating with the Database Server requesting for information and other transaction processes.
- **Networking cables**– these are needed for communication links in the Local Area Network and Wide Area Network.
- **Printers** – These are going to be used to print point of sale receipts and sales report for management.
- **Server** –data repository store used by the organization. Mysql database will be resident on the server to store data and allow access to data and information.

On the stand-alone, network model, all activities of initiating service requests (for data processing) and deploying the services are vested in a single computer that operates alone. Even if they are many computers in an organization, if it is a standalone network, the individual computers do not have any links; therefore, do not communicate with each other. The analyst shall compare the two models of architecture in the table below to select the suitable one.

	Client-Server Based	Stand -Alone
Cost	Very high	Low
Control and Security	Very high	High
Ease of Development	High	Low
Room for Future Growth	Very high	High

Table 4.1 Comparison of client server and standalone architecture.

Taking the two architectures into account, the analyst has opted for the client-server based architecture.

Architectural Design of the proposed system

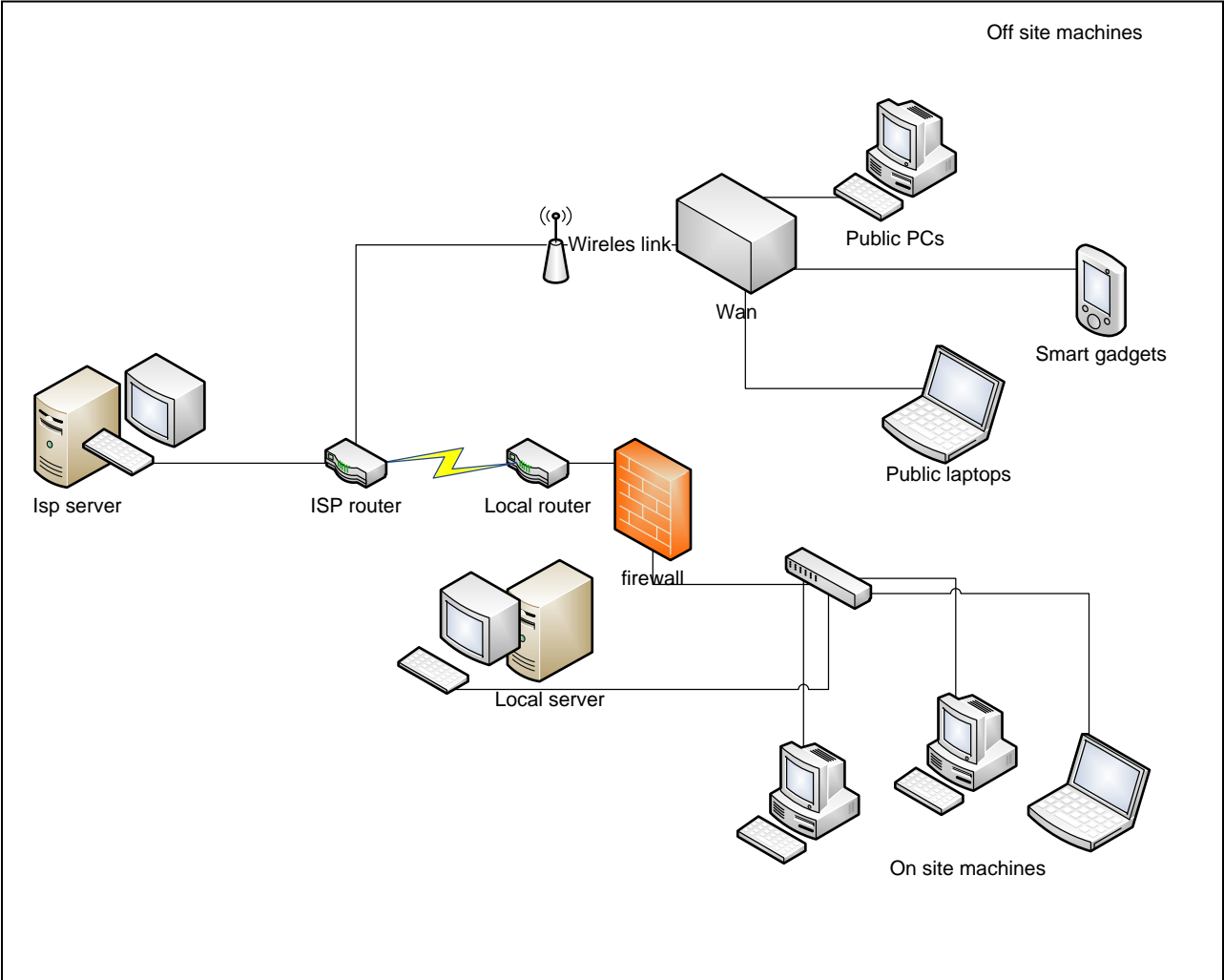


Fig 4.3 Architectural design of proposed system

4.4 Physical design

Physical design describes the solution of the system in concrete implementation terms. Shelly et al (2001) describes this process as the physical outlay that is going to characterise the proposed system. The most important aspect is that of the interaction between the hardware and the software under development. The Internet revolves around the client-server architecture. A personal computer has got web browsers that it runs so as to interact with software that is resident on the web server located at a remote site in the user's perspective. Browsers interact with the server using a set of instructions called protocols. These protocols help in the accurate transfer of data through requests from a browser and responses from the server. The model below examines the client-server inter-communication for server side scripting technologies which is implemented in the tender processing system.

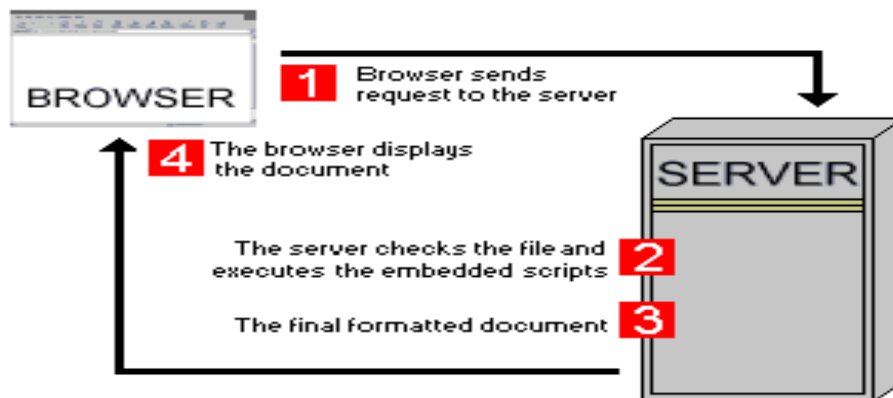


Fig 4.4 Model of the client-server architecture

A request sent for a PHP page from a client is passed to the PHP interpreter by the server along with various program variables. The interpreter then processes the PHP code and generates a dynamic HTML output. This is sent to the server which in turn redirects it to the client. The browser is not aware of the functioning of the server. It just receives the HTML code, which it appropriately formats and display on the client's computer.

Diagram showing the physical design

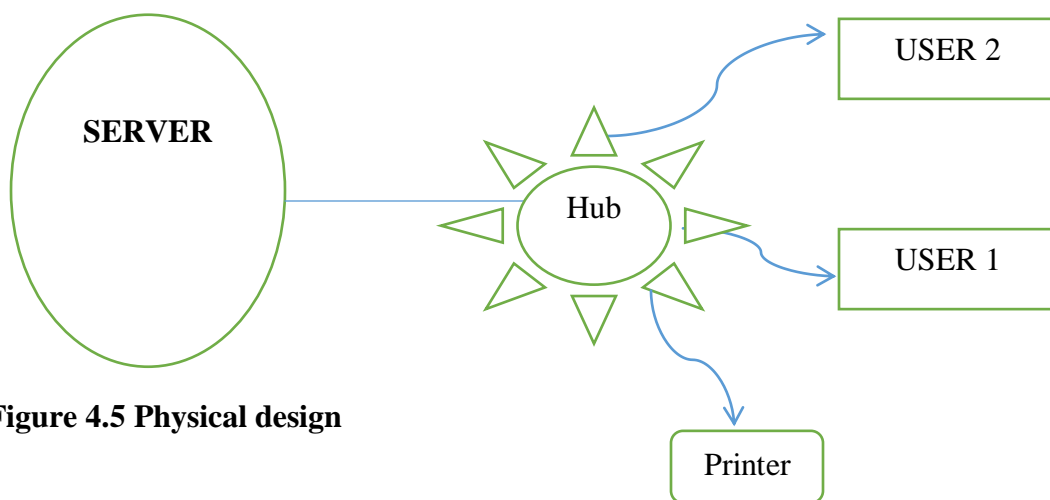


Figure 4.5 Physical design

4.5 Database Design

Satzinger et al (2002) defines database design as the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a Data Definition Language, which can then be used to create a database. In the relational model these are the tables and views Whitten et al (2003), defined database as an organized mechanism that has the capability of storing information through which a user can retrieve stored information in an effective and efficient manner. The analyst is going to use a database as a central repository of data pertaining to the online registrationsystem. This system will be linked to the core system, a program to be written in php. A database will take care of all the complex file handling and pointer manipulation that is necessary to build a fast and efficient system.

4.5.1 Database Architecture

Diagrammatic representation of the database levels

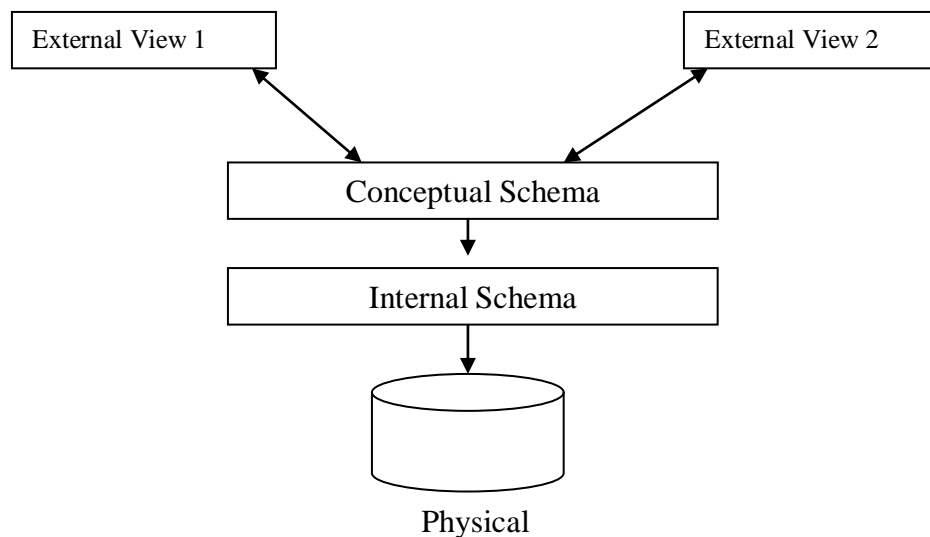


Fig 4.5 Database Abstraction levels

Physical level-Satzinger et al (2002) defines it as the lowest level of abstraction that defines how data is actually stored.

Conceptual Level -Describes what data is actually stored in the database and the relationships that exist amongst the data.

External View-This level shows the highest level of abstraction. Its main aim is to simplify the user's interaction with the database by providing an interface that the user can simply manipulate. The database records can be viewed using forms, reports and phpMyadmin (a database management interface).

Possible relationships between tables in the given database are:

- One to many- In this case there is one particular item that may be related to many things that are there for example one company being related to many bids
- Many to many-In a "many to many" relationship, one record in either table can relate to many records in the other table.
- Many to one – in these case many entities are sharing the same attribute.

Cardinalities:

Whitten, et al (2003) states that cardinality show how many times an instance of one entity is related to an instance of another entity.

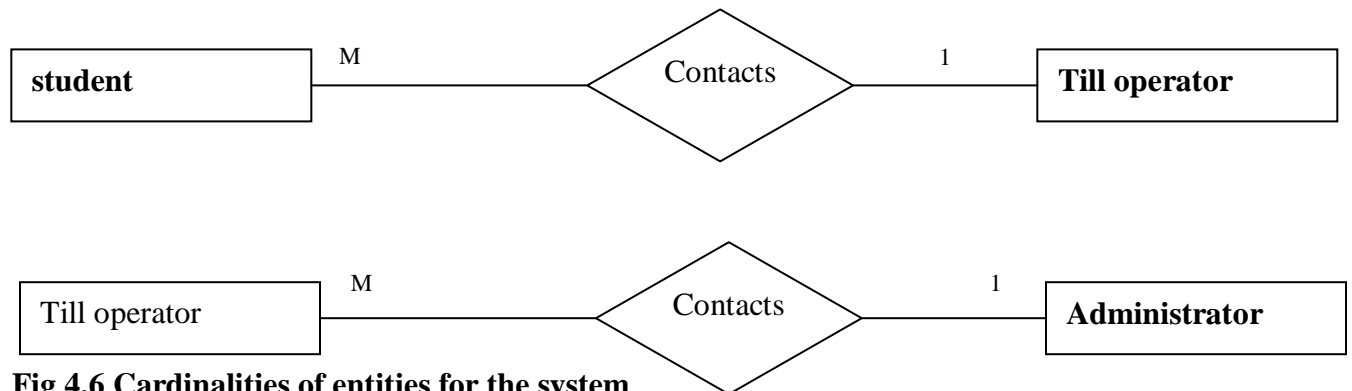


Fig 4.6 Cardinalities of entities for the system

Reasons of using relational databases

- They support data needs and are good data handlers.
- They effectively support operational needs such as updates, retrieval, deletion and other functions that are required on stored data.
- They aid in implementing measures that will reduce external manipulation.

4.5.2 Database Tables

Tables are database elements in which the actual data is stored in relational databases.

\

Parent Tables

These are the main tables that hold the most frequently used data. The system parent tables are listed below

Field Name	Data type	Length	Mandatory/ Optional	Attribute Remarks
employee_id	integer	11	M	Primary key
fullname	vvarchar	255	M	Not null
designation	vvarchar	255	M	Not null

Table 4.7 description of the employees table

Field Name	Data type	Length	Mandatory/ Optional	Attribute Remarks
user_id	integer	11	M	Primary key
employee_id	integer	11	M	Not null
username	vvarchar	255	M	Not null
password	vvarchar	255	M	Not null
usergroup_id	int	11	M	Not null
active	vvarchar	255	M	Not null

Table 4.8 description of the users table

Field Name	Data type	Length	Mandatory/ Optional	Attribute Remarks
account_topup_id	int	11	M	Primary key
account_Id	int	11	M	Not null
amount	decimal	10	M	Not null
paymentdescription	varchar	255	M	Not null
date	datetime	0	M	Not null
user_id	Int	11	M	Not null
receiptno	Varchar	255	M	Not null
Amounttendered	Decimal	10	M	Not null
Change	decimal	10	M	Not null

Table 4.9 description of the account top up table

Field Name	Data type	Length	Mandatory/ Optional	Attribute Remarks
meal_id	int	11	M	Primary key
mealcode	varchar	255	M	Not null
mealdescription	varchar	255	M	Not null
price	decimal	10	M	Not null
unitcost	decimal	10	M	Not null

Table 4.10 description of the meal items table

Field Name	Data type	Length	Mandatory/ Optional	Attribute Remarks
receiptheader_id	int	11	M	Primary key
receiptno	int	11	M	Not null
date	datetime	0	M	Not null
paymentmethod_id	int	11	M	Not null
client_id	int	11	M	Not null
total	Decimal	10	M	Not null
lineitems	int	11	M	Not null
user_id	int	11	M	Not null
amounttendered	Decimal	10	M	Not null
chenji	Decimal	10	M	Not null
vat	Decimal	10	M	Not null
accountbalance	Decimal	10	M	Not null
tdate	datetime	10	M	Not null

Table 4.11 description of the receipt header

4.6 Interface design

According to Whitten, et al (2003), defines interface design as graphical controls that the user interacts with to carry out various desired processes. The user interface avails interaction between the user of a system and the system, hence it provides a means of communication between the two entities. User interface also encompasses data input and output platform such as forms and reports that users use to input data and also view the output of processed data of the system. The Graphical User Interface that will be used in the proposed system will be designed in such a way that users will require minimum training as ease of navigation of the system will be a feature.

4.6.1 Input Design

Input design is the construction of input forms used by users to input data into the system. It shows the highest level of abstraction and hides the complexity of the system. The core goal for input design is to design a user friendly interface, and to ensure input processes that ensure data quality, accuracy and timeliness.

Login screen

This is a screen that will be used by all users to get access into the system it will allow them to enter their credentials for validation and authentication purposes.

The diagram shows a rectangular frame representing a login screen. At the top center, the word "LOGIN" is written in bold. Below this, on the left side, are the labels "User Name" and "Password". To the right of "User Name" is a rectangular input box. To the right of "Password" is another rectangular input box. Below the "User Name" label and its input box is a button labeled "Login". Below the "Password" label and its input box is a button labeled "Close".

Fig 4.12 Login form design

The proposed system will contain a meal item input form that will allow users to enter all the necessary details as shown below:

CREATE MEAL ITEM	
Add/Edit meal item	
Meal code	<input type="text"/>
Meal description	<input type="text"/>
Meal price	<input type="text"/>
Meal Cost	<input type="text"/>
	<input type="button" value="Cancel"/> <input type="button" value="Save"/>

Fig 4.13 Meal item form design

4.6.2 Output Design

It is very imperative to present the results of the system, from the data entered into the system. The starting point for the development of any system is the output design. This is because the designer must know what the user requires by way of output from the system before he can start working on the system development. The following output screens and reports guidelines are essential in interface design:

- Each and every screen and report must have an appropriate title or caption that gives an insight of its contents.
- Information must be appropriately grouped as shown below:

Receipt							
Chinhoyi University Of Technology Student Canteen Account Topup 067 22203-5 <i>Price in US</i>							
Date:01.02.2014							
RegNumber:c1543534h							
Receipt Number:cut56490							
Account Balance: 10.00							
Till operator: James							
Description	Amount						
Account Topup	5.00						
	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px;">Total</td> <td style="padding: 2px;">5</td> </tr> <tr> <td style="padding: 2px;">mount tendered</td> <td style="padding: 2px;">20</td> </tr> <tr> <td style="padding: 2px;">Change</td> <td style="padding: 2px;">15</td> </tr> </table>	Total	5	mount tendered	20	Change	15
Total	5						
mount tendered	20						
Change	15						
<i>Thank you! Call again..</i>							

Fig 4.14 Account topup receipt form design

4.7 Conclusion

The design phase was done as the developer managed to come up with an interface of the new system. The flow of the system was outlined, inputs, processes and outputs were designed hence a blueprint of the system was established leaving the programmer with the capacity to code and construct the new system. To come up with a design acceptable by system users wide consultation was carried out from the users by the developer to mitigate software crisis where the delivered system will not meet expectations of the users. Completion of the design phase paved way for the implementation phase.

Chapter 5: Implementation phase

5.1 Introduction

Hughes et al (2002) propagates implementation as a phase which involves making the new system available to a prepared set of users (the deployment), and positioning on-going support and maintenance of the system within the performing Organization (the transition). The emphasis of this phase is on implementing the developed system and finding out whether the objectives cited in the problem definition have been met. It entails how the proposed system was implemented and it involves:

- Testing of system
- Pseudo code of the system
- Validation
- Verification
- Installation
- User training
- System conversion
- System operation

5.2 Coding (Pseudo Code)

Synergy (2001) describes coding as turning program logic into specific instructions that are to be executed by the computer system. Hypertext pre-processor (PHP) is the server side scripting language that was used with MySQL as the database backend. The system functionality was developed as various modules. The modules were finally integrated into one working system. Below are some of the important modules that were integrated to bring out a whole system.

User opening system

Open the System

Then Display Login Form/Interface

Login

Enter username and password

 If correct then

 Go to main menu

 Else

 Try again

 End if

 End if

Creating meal items

Validate all the information

 If invalid input is entered

 Report error

 Else

Using the established connection, save details

Updating data in the database

Get the key fields

Check if record does exist

 If not then

 Report error

 Else

 Validate all the information

If some of the input is invalid

Report error

Else

Using the established connection, save record

Searching for a record

Get the record

Using the established connection, retrieve data

If data has not been found then

Report error

Else

Display data

End

5.3 Testing

O'Brien (1996) defined testing as identifying errors with the aim of debugging system prior to the installation and full deployment of the system. The system can be installed on a machine to conduct tests in regard of errors such as syntax errors of which errors may compromise on the quality and efficiency of the system.

The testing for Chinhoyi University DH system was done in the following phases:

- Unit testing
- Module testing
- Integration Testing.
- System testing
- Acceptance testing

The diagram shows the procedure in testing:

Testing procedures:

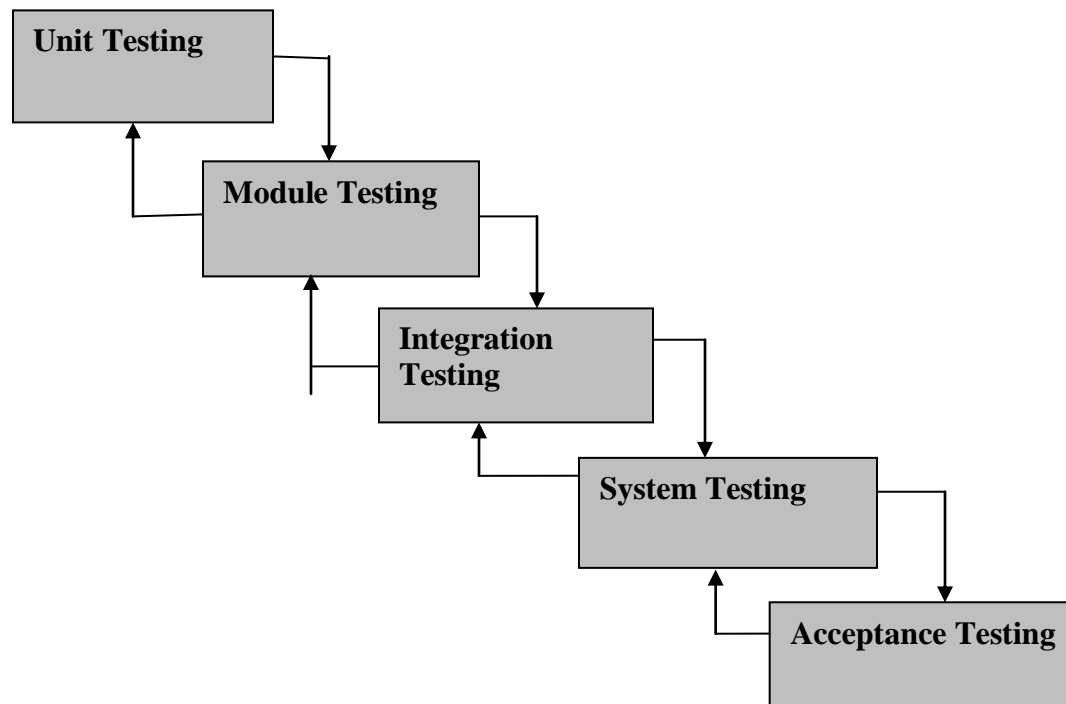


Fig 5.3: Testing procedures

5.3.1 Unit Testing

The IEEE-SA Standards Board (1998) states that unit testing involves the testing of individual components separately. It also specifies how basic program information systems requirements will be verified. Additionally, it provides-at a higher level; a strategy for verifying software features and/or functions that operate as defined in the requirements. This method was used during password testing as shown below.

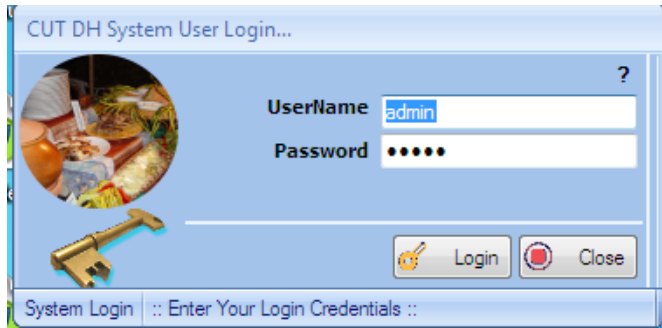


Figure 5.1 Login test to illustrate unit test

The objective of unit testing is to identify and eliminate the execution errors and any remaining logical errors.

5.3.2 Module Testing

According to the IEEE-SA Standards Board (1998) module testing involves testing of a collection of independent components like procedures and functions which make up a module. Module testing involves testing of module by module independently from other modules, that is testing of all related components at a time ascertaining if they perform tasks required from them. An example is the meal items module to see if all its underlying code was functioning.

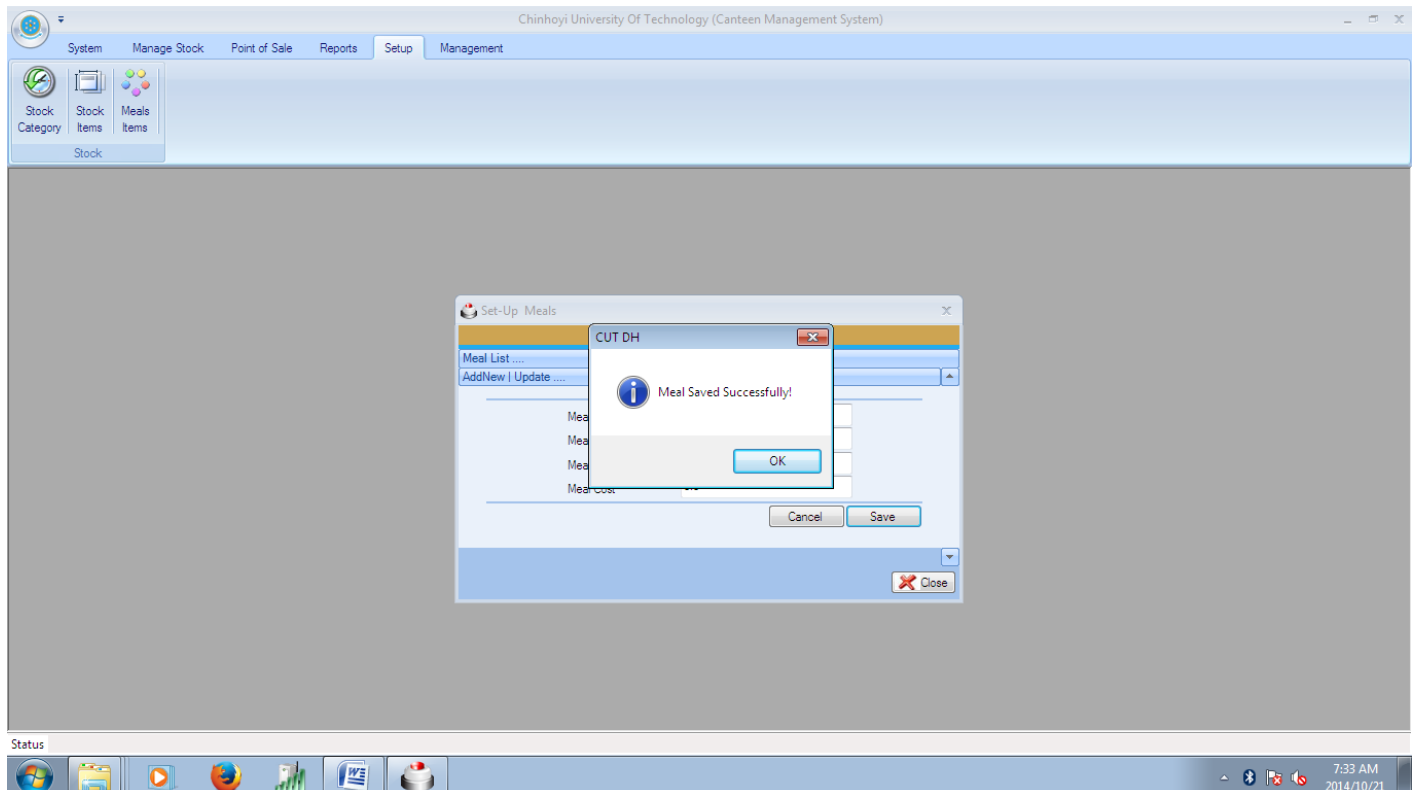


Figure 5.2 Module testing of the meal module

5.3.4 Integration Testing

Williams (2006) propagates that this process involves detection of inter-surface mismatch and rigorous exercise of all interfaces. It makes use of the testing two or more modules working together to ensure that they are performing according to specifications. It ensures that the job streams are correct and requires the analyst to test whether there is integration of interfaces in the different parts of the system. Units that have passed unit testing were combined to see if the modules were functioning as expected.

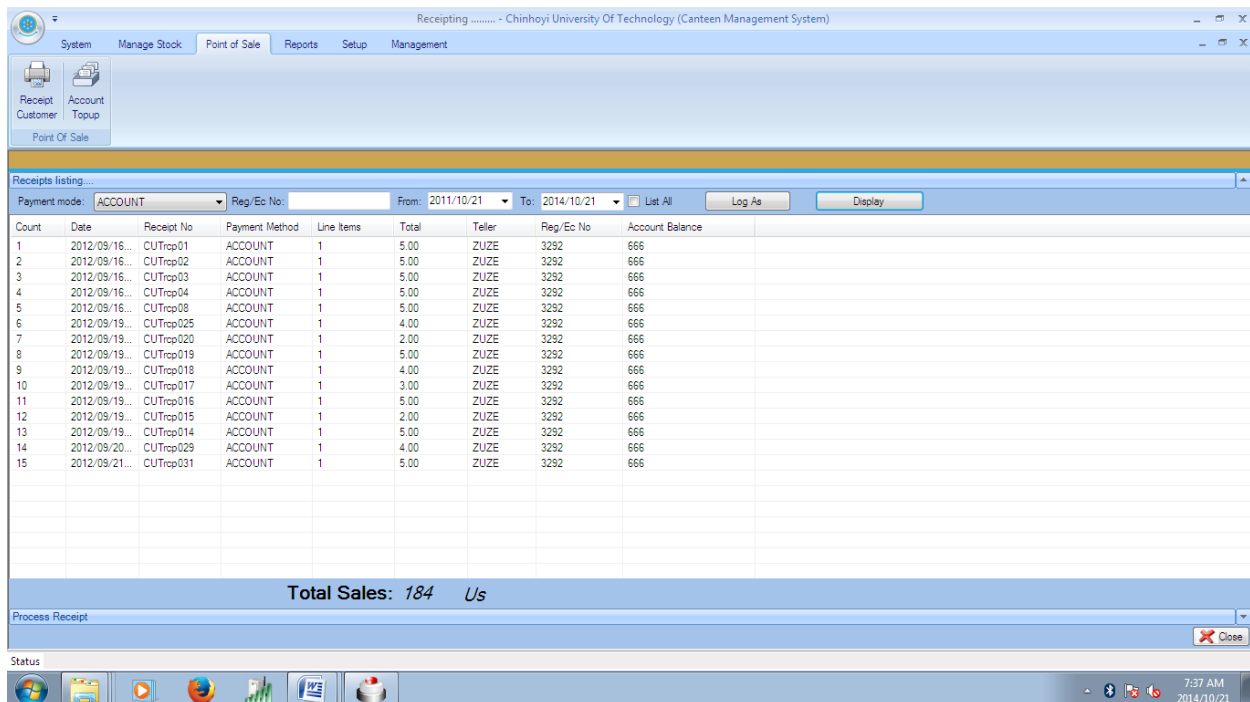


Figure 5.3 Integration testing of the receipting module

5.3.5 System Testing

The system test plan must identify a strategy for verifying the integration of system components as defined in the system specification, Williams (2006). It provides test coverage for all components of the system. Components including software, hardware, external interfaces, staff documentation, installation activities and conversion programs were used during this phase. Reports are an example of this test as they need the whole functioning of the whole system with even hardware like printers. The system was converted into an executable file and the researcher

tested to see if the system performed the required functions. The system was able to retrieve records from the database, add records to the database, deliver reports and execute notifications.

5.3.6 Testing methods:

Three testing methods were used and these include White Box Testing, Black Box Testing and Defect Testing.

Black Box Testing: It is also known as Functional Testing and Williams (2006) describes it as a test that involves as a set of inputs that fully exercises the functional requirements of the system. It focuses on the overall functionality of the software. With Black box testing, it will be an attempt to find errors in the following categories; incorrect functions, interface errors, performance errors and initialization errors.

Advantages of black box testing

- Test is unbiased because the tester and the designer are independent of each other.
- The test is done from the point of view of user not the designer.
- The tester does not need knowledge of any specific programming language.

Disadvantages of black box testing

- Testing every possible input stream is unrealistic.
- Test cases are difficult to design.

White Box Testing (Logical/Structural Testing): It focuses on the internal working detail of a unit and identifies errors that cannot be shown through black box. This means that a study of the program is made to try and test each possible path in the program at least once. This technique pays detail to the internal processes of the system

Advantages of white box testing

- The test is able to inspect the internal state of the box after the test has been run. This can be useful to ensure that internal information is in the correct state regardless of whether the output was correct or not.

Disadvantages of white box testing

- As knowledge of code and internal structure is a prerequisite, a skilled tester is needed to carry out the test which makes the test expensive.

Defect Testing: There was use of defect testing at first, as a way of discovering defects within the system. This is mainly intended to test the system so that defects are uncovered before the system is delivered. The diagram below shows an outline of the defect testing process.

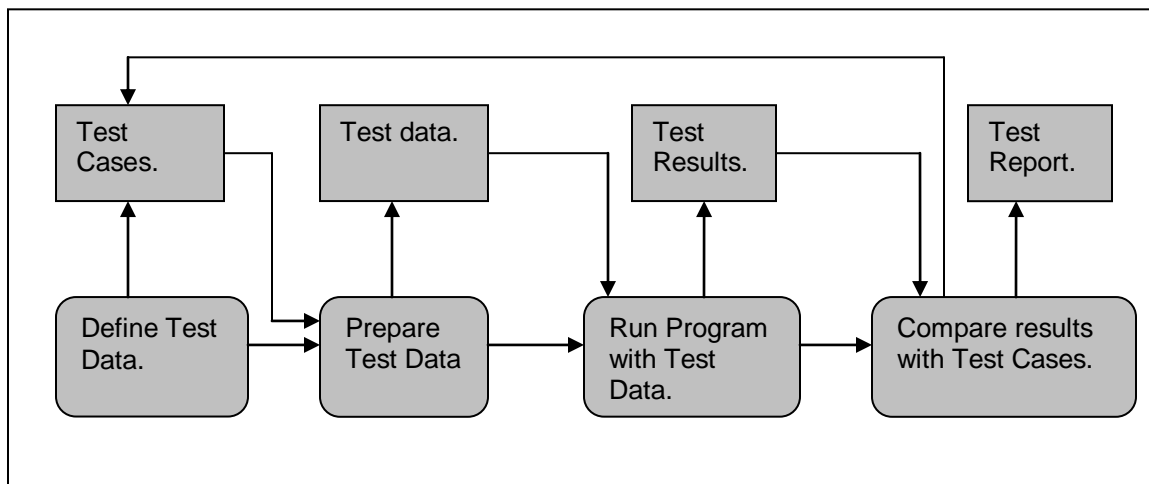


Figure 5.5: Defect Testing

Explanation of the Diagram:

- **Test Cases:** These are the input and output specifications and a statement of the module under testing.
- **Test Data:** These are the data inputs, which are devised to test if the system will compile relevant reports and queries as per system specification.

- **Test Results:** These are the outcome of each test run. They are compounded with test cases to see whether programs were running properly.
- **Test Report:** This is a report which is prepared at the end to highlight the important considerations in the test.

Acceptance Testing

This is the final stage after all the above tests were completed, acceptance tests were then performed. The researcher tested the system with the data supplied by the users rather than simulated test data. Errors and omissions in the system were discovered and they required definitions. The researcher continued until there was an agreement between the management and him.

5.3.7 Verification and Validation:

Verification

Shelly et al (2001) propagates that with alpha testing, we sought to answer the question “Are we building the product right?” This refers to a set of activities that ensure that software correctly implements a particular function. Primarily, what will be looked for are errors and omissions regarding end-user and design specifications that were specified earlier but may not have been fulfilled during construction. Requirements specification and the actual system were compared and proved that what the system does basically solved all the stated problems.

Validation

According to Bezier (2003), Validation is the process of evaluating the software at the end of the software development process to ensure compliance with requirements. That is, whatever the software developed, it should do what the user expects it to do. Validation seek to answer such questions as “Are we building the right software?” validation was carried out so as to determine whether the development of the right software that conforms to its prescribed user requirements. It seeks to ensure that the implemented program meets the expectations of the software users. The system was able to warn the user if wrong data is entered in the system i.e. if the user enters text data in a number text box, the system alerts the user to input the right data. Validation testing also overlapped to a large extent with system testing, where the application was tested with

respect to its typical working environment. Consequently for many processes no clear division between validation and system testing can be made. Specific tests which can be performed in either or both stages include the following:

- **Regression Testing:** Where the software was tested with the automated test harnesses to ensure that the required features of the previous version are still working in the new version.
- **Recovery Testing:** Where the software was interrupted in a number of ways. For example taking its hard disc off line or even turning the computer off, to ensure that the appropriate techniques for restoring any lost data will function.
- **Security Testing:** Where unauthorized attempts to operate the software, or parts of it, are attempted. It also included attempts to obtain access the data, or harm the software installation or even the system software. As with all types of security it was recognized that someone sufficiently determined would be able to obtain unauthorized access and the best that can be achieved was to make this process as difficult as possible.
- **Stress Testing:** Where abnormal demands were made upon the software by increasing the rate at which it was asked to accept data, or the rate at which it was asked to produce information. More complex tests may attempt to create very large data sets or cause the software to make excessive demands on the operating system.
- **Performance testing:** Where the performance requirements, if any, were checked. These included the size of the software when installed, the amount of main memory and/ or secondary storage it required and the demands made of the operating system when running within normal limits or the response time.
- **Usability Testing:** Even if usability prototypes have been tested whilst the application were constructed, a validation test of the finished product will always be required.
- **Alpha and Beta Testing:** This was where the software was released to the actual end users. An initial release, the alpha release made to selected users who would be expected to report bugs and other detailed observations back to the production team. Once the application has passed through the alpha phase a beta release, possibly incorporating changes necessitated by the alpha phase, can be made to a larger more representative set users, before the final release was made to all users.

5.3.8 Test results

The following are the actual test results that were observed as the tests were actually performed. Only an extract of the test results screenshots has been included in this section.

Login

If a user enters a wrong username or password the following login denial message will be displayed

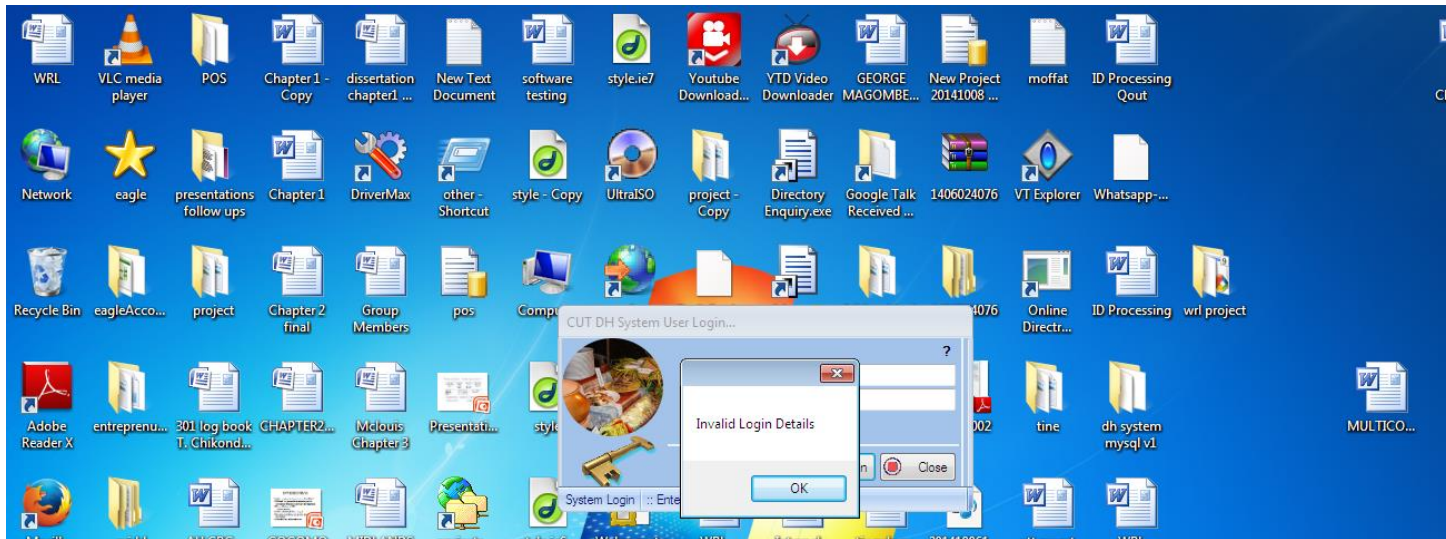


Figure 5.6: login failure test

Null Field validation

If a user submits a form with unfilled mandatory fields, he/she will be prompted to do so.

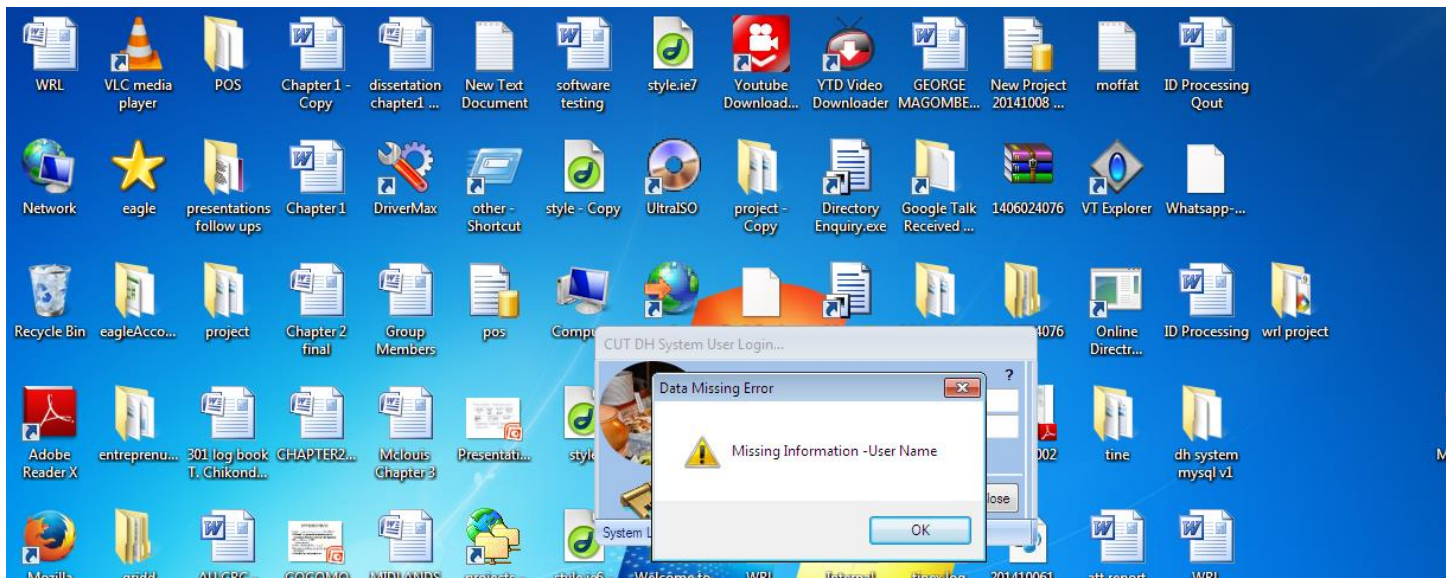


Figure 5.7: Null field validation test

Entering of the existing data

If user enters data that already exist the system will inform the user that information exists already.

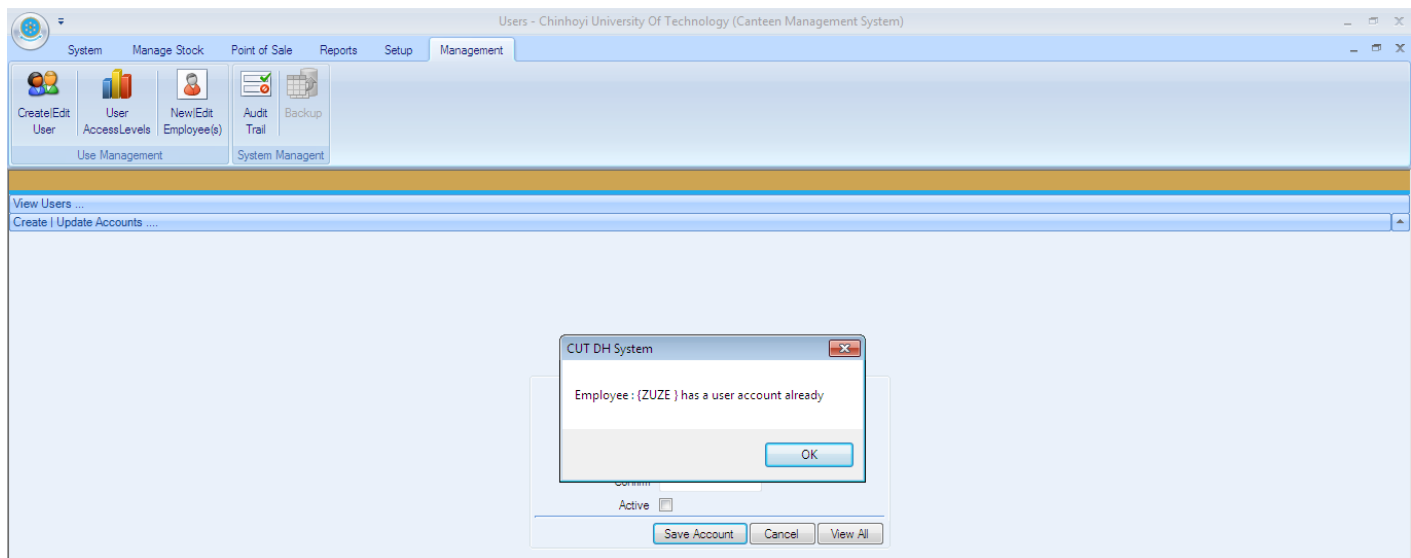


Figure 5.8: Wrong data upload test

Summary of test results

- Validation was well implemented for all field data types.
- The system is performed all the intended functions satisfactorily.
- The security features of the system are satisfactory and a guarantee can be placed on the reliability of the system's processing activities.
- All users accepted that the system is functioning as they anticipated.

5.4 Installation

The system was installed on the web server within the host company. The installation process was as follows:-

- Installation of windows.net version 3.5.
- Installation of CUT DH system.
- Installation of MySQL Manager.
- Installation of Adobe Dreamweaver CS8

5.4.1 Methods of conversion

This is the stage where the issue of switching all operations from the old system to the new system in a smooth way is considered and the process should guarantee the continuity of operations during and after the conversion period. Several possible methods of conversion were available to implement new systems and these are:

- Pilot conversion
- Direct conversion
- Phased conversion
- Parallel conversion

Pilot Conversion

With this conversion, the system is installed to a small section in the organization, for testing purposes. That is to say that the system will be used by a selected group of users who will further assess its acceptability and functionality. Cost is relatively moderate since only one location runs both systems. Risk is also relatively moderate as risk of failure is reduced to the pilot site.

Direct Conversion

This is whereby the new system replaces the old one in its entirety in one go. The old system is rendered obsolete and all the departments that were using it will now start carrying out their daily activities under the new system. The cost incurred is relatively low because one system is in operation. However risk is high for there is no backup option.

Phased Conversion

The new system is installed in phases allowing the users to become accustomed to its use as well as to slowly phase out the old system. Cost is relatively moderate because the system is implemented in stages. Risk is also relatively moderate because the risk is limited to the module being implemented.

Parallel Conversion (recommended strategy)

We implemented this approach since it involves running the two systems together at the same time. This gives the users a solid platform on which to fall back on if they discover that the new system is not functioning as well as it should. Cost is relatively high as both systems are in operation for the changeover period. Risk is relatively low due to the existence of backup options. A parallel run is done to ensure that all users get used to the system and that data is safely moved to the new system. Steps in parallel conversion are:

- Installation necessities to all terminals
- Train users on the use of system
- Data capturing
- System Process all activities using old and new system.

Justification of Parallel Conversion

- Risk is relatively low since back up (existing system) exists.
- Data is input into both systems and results obtained from both systems can be compared and verified.
- The users are subjected to gradual change that they can easily follow thus they are motivated and not demoralized by an abrupt change.
- Reference could be made to the old system whenever anomalies are found in the new system during this conversion period, this would assist in drawing reconciliation in such abnormal situations and ensuring continuous business operation

A major point to note is that the system in picture here operates from a web based portal and thus can be implemented on one site for hosting and all its technical processes so other methods like the pilot which involve two sites for implementation are irrelevant.

5.4.2 Training

This entails all the processes that were done ensure that the intended users become intimate with the new system.

In-house Users

A training plan was considered early in the system development process and an appropriate training schedule for users and administrators was put in place. Since the system was developed in house, in-house training was used.

Post implementation

It was discovered that the new system was accurate and timeliness in the producing of output. It also yielded also a high level of user satisfaction. Generally the new system was reliable and maintainable. It had also better system control and security. The users responded well to the training and they deduced that the new system was user friendly and had an effective database that added business value scheme.

5.5 Maintenance

Maintenance is an important aspect that will guarantee the durability and long term functioning of any system. There was need to ensure that management had an appreciation of the importance of system maintenance so that they could dedicate adequate financial resources to support the maintenance plan. The management was taught that maintenance is an important process to be given good attention if the system is to live longer while delivering good results.

System maintenance is important because:

- A system's parameters continues to change and evolve as time progresses
- The changes will be arising from change request due to the problems cited by reports from operating groups who identifies the bugs in the system.
- Changes will be arising from users' preferences and technological advances.

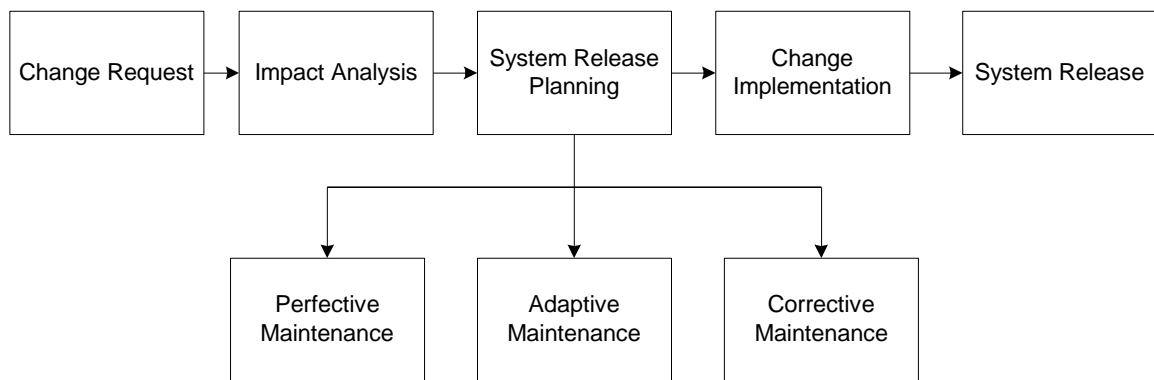


Figure 5.9: The Maintenance Process

5.5.1 Corrective Maintenance

All tests performed on the system up to the time of delivery may or can never be deemed to have been 'completely exhaustive' therefore some unidentified bugs (program code errors) which affect the normal functioning of the system may be discovered as the system is in operation.

Bugs may be in the form of miscalculations, truncation or concatenation. Immediate action then

has to be taken to rectify those bugs that compromise the security objectives by notifying the developers of the system to address the problems and then test whether the problems have been rectified.

5.5.2 Adaptive maintenance

The environment under which the system operates may impose certain new requirements that call for change. Changes in such areas as legislation may impose new operating regulations for all companies. Assuming the regulations of internet and websites have changed or have been adjusted adaptive maintenance approach may need to be taken so as to adapt and make the system compliant with those new requirements.

5.5.3 Perfective maintenance

This is an ever going process that is caused by the advent of new technologies due to the dynamic nature of the Information Technology industry. More and more efficient techniques of handling systems and their functions will always be discovered. Besides technological advances, there may be some modules that would not have been made optimally due to constraints such as money or any other resource shortages; it is these issues that are dealt with during this maintenance. During perfective maintenance the goal is to implement a better version of what is already in place, as well as to add missing functionalities. This is achieved by first assessing whether it is worth the effort to perfect the system to those extents.

5.5.4 Backup services

To help maintenance become a possible process, a backup of the system and all its associated components has to be done. Backup is categorized into:

- System application backup
- Database backup

System application backup

The system application must have its own independent backup. This is done to allow reinstallations if the need arises. The system can thus be reinstalled in cases that the system is not functioning due to any reason that may cause system function not to be as expected.

Database backup

Database backup is in the following stages:

- Primary Backup
- Secondary Backup

Primary Backup

The Database Management System as set by the administrator does this. To invoke this facility the MySQL Server's Administration facility is made use of. Care should be taken to set the following

Parameter to set	Parameter value
Frequency	Everyday
Backup files	Database files
Backup path	Any directory not in the same directory as the database

Table 5.10 Backup Parameters

Secondary Backup

Secondary is centered on backup that is to a secondary backup storage; that is Backup tapes or Compact Disks. These can be kept on site and some are stored offsite. Offsite backup premise will help in cases of physical disasters on the site. Secondary backups help to secure the companies data so that it will be safe from internal company disasters.

System Security

The system should be regularly monitored to ensure that no unauthorized persons get access to the system. The authorized persons should only know the system's password and can be altered on regular basis to ensure maximum security. There is physical based security and software based security.

Physical Security

Physical security was achieved through adopting the following physical procedures:

Physical Locks – located in the IT Server rooms. Access to the server rooms is to be restricted to IT staff only.

Fire Control Equipment – in case of fire, smoke detectors have been put in place to send and alarm as soon as enough smoke that could be interpreted as fire is detected.

Software Based Security

Should a malicious user bypass impede the physical security measures, software based measure were also implemented and these include:

Database Access Passwords – Access to the Data Server is only limited to users with passwords to the Server. And once logged on, access levels assigned to the user determine operations that are to be undertaken by the user.

System Passwords User Names and Passwords – for all client machines, users of the system are going to be assigned user profiles.

Antivirus software- use of antivirus software should be done to protect the system from malicious programs.

Firewalls-This is going to be a web based software so its protection from the outside world has to be a priority since we have hackers prying over the internet.

5.6 Conclusion

All the objectives of the system were met successfully despite other hindrances like time and cash constraints. The development of the system was objective driven. Other evolving user requirements not mentioned in the proposal were also incorporated into the system. All the activities of the project were guided by the plan laid out during feasibility study and were within budgetary constraints. Also the risk mitigation measures that were put in place during feasibility led to resounding success of the project.

5.6.1 Recommendations

From what was gathered throughout the Life cycle of the project, it was recommended that:

- The system be installed and begin to be used with immediate effect.
- All users should stick to the basics learnt during the training, and if any problems are faced they should refer to the User Manual.
- The users should ensure responsibility when using the system and that they should not disclose their password to any unauthorized personnel or let anyone temper around with the system.

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Appendix A - User Manual

Introduction

This user manual can be used as a guide to the system users on how to use the dining hall system.

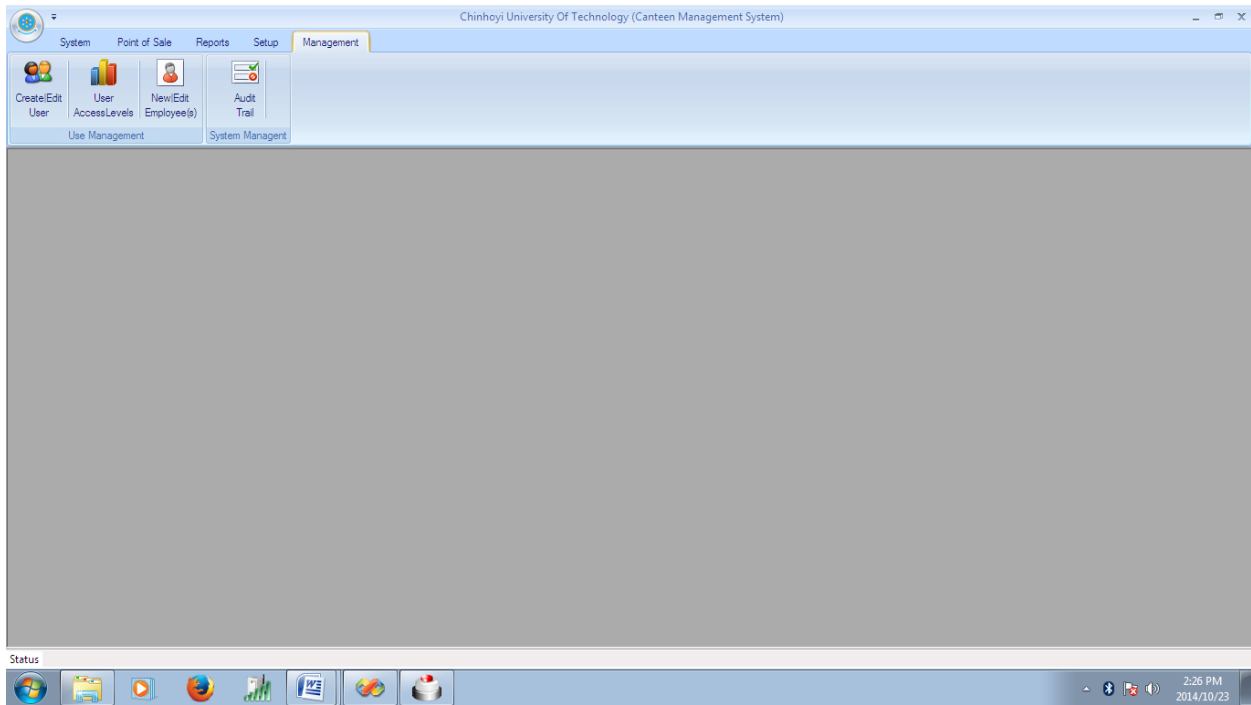
The icon circled below is used to start the application.



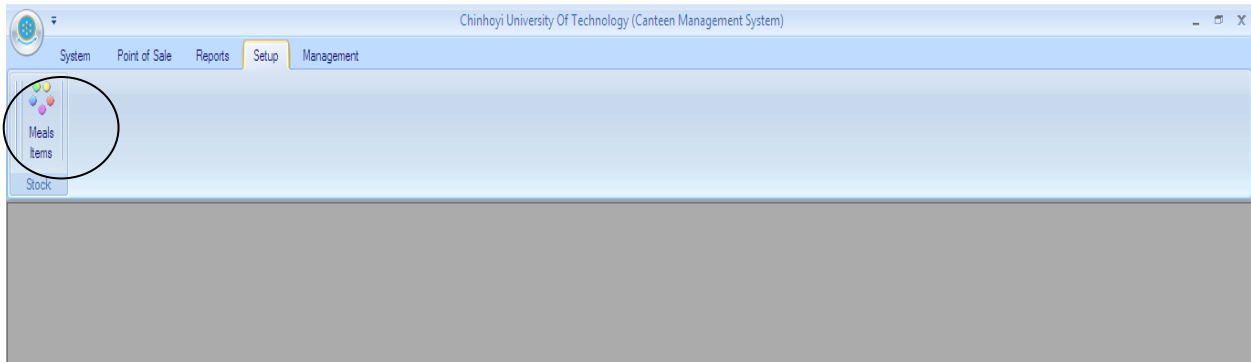
Double clicking on the icon labeled CutStudentCanteen – Shortcut on the user’s desktop will result in the login screen popping up.



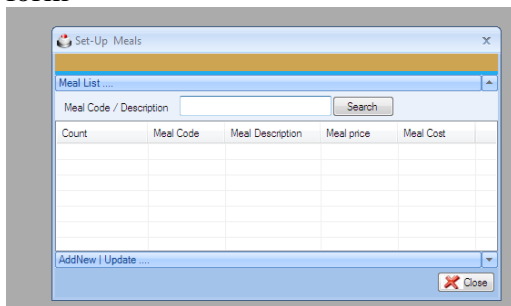
Successful login will result in the popping up of the main menu. Below is a screen shot of the main menu



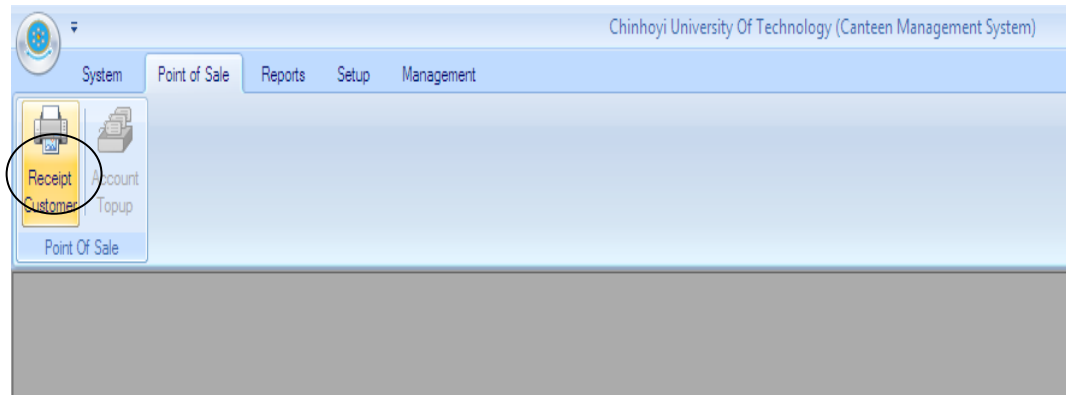
to create meal items user clicks on setup tab circled in the fig below



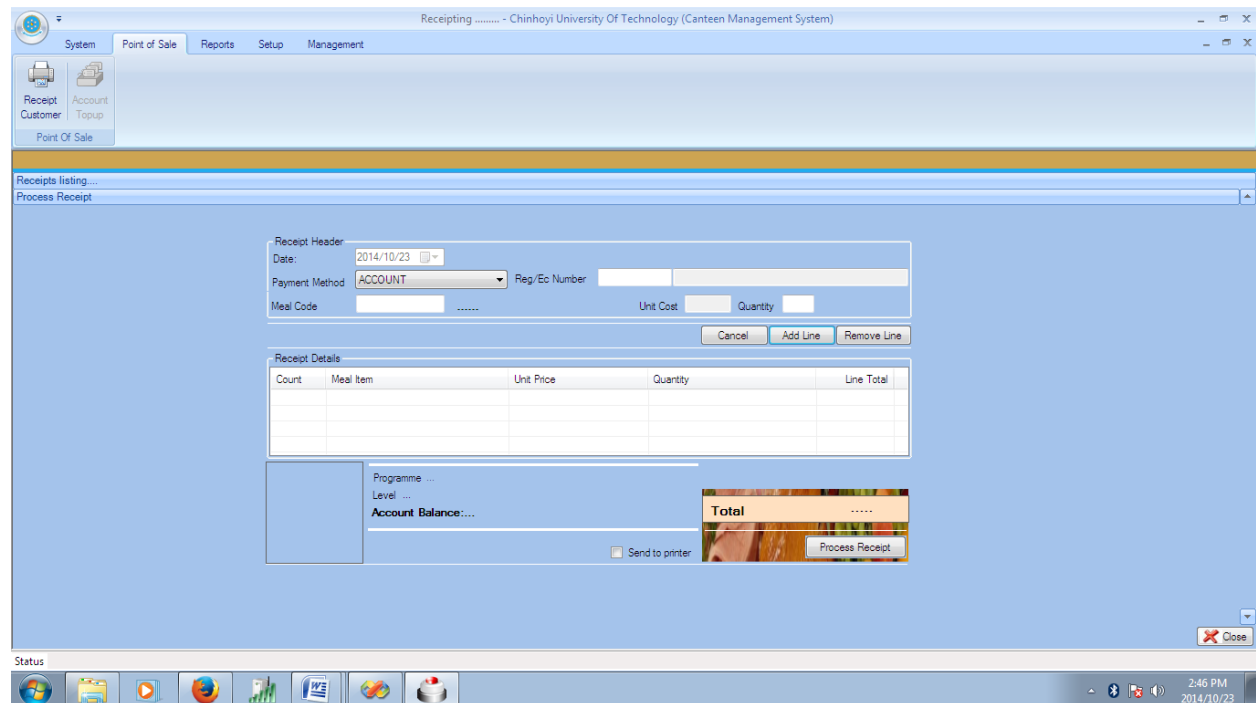
Clicking on the circled menu item labeled meal items will result in the popping up of the below form



to receipt a topup payment from a student the user clicks on the point of sale tab circled in the fig below



Clicking on the circled control labeled receipt customer will result in the displaying of the from below



Inputting data in the above and clicking on the process button circled above will result in the processing of a payment and generation of a cash sale report as illustrated by the fig below.



Appendix B - Interview Check list

Sample of interview questions conducted by the researcher

What problems are you experiencing when using the current system?

.....

Do you manage to meet your deadlines with the current system?

.....

What is the general perception of students on the current system?

.....

What do you think can be done to improve the current system?

.....

Give recommendations on why you would support the introduction of an automated dining hall system?

.....

.....

.....

.....

.....

Appendix C -Questionnaire

Chinhoyi University Of Technology QUESTIONNAIRE

1. How do you view the current system in your own opinion?

.....

2. How efficient is the current system and on average how many students do you serve per day?

.....

3. What other challenges do you meet in using the system?

.....

4. What actions can you do into the system?

.....

5. What would you want the new system to incorporate?

.....

6. Any recommendations or suggestions to the new system.

.....

7. How much time do you spend on average to process serve a student?

.....

8. How frequently do you have customer complain about your services?

.....

9. Do you have any suggestions that you feel will be of great improvement to the Current system?

Appendix D – Observation score sheet

Date:

Time:

Observation:

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

Conclusion:

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

Appendix E - Snippet of Code

database connection string

```
public static string conString = "server=" + theServer + ";database=" + conDatabase + ";uid=" + conUserName + ";password=" + conPassword + ";";
```

how to initialise a connection

```
MySqlConnection myconn = new MySqlConnection(Global.conString);
```

how to open a connection

```
if (myconn.State == ConnectionState.Closed)
{
    myconn.Open();
}
```

How to save records to the database

```
private void processtopup()
{
    //try
    //{
    if (Global.ValidateTextBox(txtaccount, "Account") == false)
    {
        return;
    }
    if (Global.ValidateComboBox(cbodescription, "Description") == false)
    {
        return;
    }
    if (Global.ValidateTextBox(txtamount, "Amount") == false)
    {
        return;
    }
    if (Global.ValidateTextBox(txtcash, "Amount Tendered") == false)
    {
        return;
    }
    if (Decimal.Parse(txtamount.Text) > (Decimal.Parse(txtcash.Text)))
    {
        MessageBox.Show("Amount Tendered can no be less than:(" + txtamount.Text + ")",
"CUT DH System", MessageBoxButtons.OK, MessageBoxIcon.Information);
        return;
    }
    else
    {
        Decimal dcchange = Decimal.Parse(txtcash.Text) - Decimal.Parse(txtamount.Text);
        txtchange.Text = dcchange.ToString() + ".00";
    }
}
```

```

if (myconn.State == ConnectionState.Closed)
{
    myconn.Open();
}
string tDay = dttransactiondate.Value.Day.ToString();
string tMonth = dttransactiondate.Value.Month.ToString();
string tYear = dttransactiondate.Value.Year.ToString();

string tdate = tYear + "-" + tMonth + "-" + tDay;

string nwdate = DateTime.Now.ToString("yyyy-MM-dd HH:mm:ss");

string Strsql = "insert into
tblaccounttopup(account_id,amount,paymentdescription,date,user_id,amounttendered,debi)values
(" + Global.intclient_id + "," + Decimal.Parse(txtamount.Text) + "," + cbodescription.Text +
"," + nwdate.ToString() + "," + Global.intuser_id + "," + Decimal.Parse(txtcash.Text) + "," +
tdate + ")";
MySQLCommand cmd = new MySQLCommand(Strsql, myconn);
cmd.ExecuteNonQuery();
cmd.CommandText = "SELECT last_insert_id()";
Global.intreceipt_id = Convert.ToInt32(cmd.ExecuteScalar());

string strReceiptno = "RC00" + Global.intreceipt_id.ToString() + "TP";
cmd.CommandText = "update `tblaccounttopup` set `change`=" + txtchange.Text +
",`receiptno`=" + strReceiptno.ToString() + " where `acctopup_id`=" + Global.intreceipt_id +
"";
cmd.ExecuteNonQuery();
cmd.CommandText = "insert into
tblmaster(account_id,credit,debit,date,reference,description)values(" + Global.intclient_id + ","
+ Decimal.Parse(txtamount.Text) + ", '0.00'," + nwdate.ToString() + "," + strReceiptno + "," +
cbodescription.Text + ")";
cmd.ExecuteNonQuery();
cmd.Dispose();

Double bal = 0;
Strsql = "select balance from tblaccounts where client_id=" + Global.intclient_id + "";
MySQLCommand mycommand = new MySQLCommand(Strsql, myconn);
MySQLDataReader drreader = mycommand.ExecuteReader();
while (drreader.Read())
{
    bal = Double.Parse(drreader["balance"].ToString());
}
drreader.Dispose();
mycommand.Dispose();

```

```

        bal = bal + Double.Parse(txtamount.Text);
        Strsql = "update tblaccounts set balance = " + bal + " where client_id = " +
Global.intclient_id + " ";
        MySqlCommand mycmd = new MySqlCommand(Strsql, myconn);
        mycmd.ExecuteNonQuery();
        mycmd.Dispose();
        MessageBox.Show("Account Topup Succesfull", "CUT DH System",
        MessageBoxButtons.OK, MessageBoxIcon.Information);
        myconn.Close();
        displayaccounttopup_receipt();
        //audittrail
        Global.logdata = "ReceiptedbyUerid:" + Global.intuser_id + "#ReceiptNo:" +
strReceiptno.ToString() + "#Amount:" + txtamount.Text + "#Purpose:" + cbodescription.Text +
"#Account:" + txtaccount.Text;
        Global.module = "frmAccountTopup";
        Global.operation = "SAVE:Receipt";
        Global.AuditTrail();
        clear();
    }

```

Extracting records from database view to list

```

lsvaccounttopup.Items.Clear();
    lbtttl.Text = "...";
    lsvtotal = 0.00;
    dateconversion();
    if (myconn.State == ConnectionState.Closed)
    {
        myconn.Open();
    }
    int count = lsvaccounttopup.Items.Count + 1;
    string sql =
"SELECT `tblregisteredstudents`.`firstname`, `tblregisteredstudents`.`surname`, `tblregisteredstude
nts`.`semester`, `tblaccounts`.`balance`, `tblaccounts`.`clientno`, `tblregisteredstudents`.`academicl
evel`, `tblregisteredstudents`.`programme`, `tblaccounttopup`.`amount`, `tblaccounttopup`.`payme
ntdescription`, `tblaccounttopup`.`date`, `tblaccounttopup`.`user_id`, `tblaccounttopup`.`acctopup_
id`, `tblaccounttopup`.`account_Id`, `tblaccounttopup`.`receiptno`, `tblaccounttopup`.`amounttende
red`, `tblaccounttopup`.`change`, `tblaccounttopup`.`deti` FROM `tblaccounts` Inner Join
`tblregisteredstudents` ON `tblregisteredstudents`.`regnumber` = `tblaccounts`.`clientno` Inner
Join `tblaccounttopup` ON `tblaccounttopup`.`account_Id` =
`tblaccounts`.`client_id` WHERE `tblaccounttopup`.`account_Id` = `tblaccounts`.`client_id` and
(`tblaccounttopup`.`deti` between " + Global.startdate + " and " + Global.enddate + ") and
`tblaccounts`.`clientno` like%" + txtsearch.Text + "%' and `tblaccounttopup`.`user_id`=" +
Global.intuser_id + " ";
    MySqlCommand cmd = new MySqlCommand(sql, myconn);
    MySqlDataReader reader = cmd.ExecuteReader();
    while (reader.Read())
    {

```

```

        ListViewItem _lvi = new ListViewItem(reader["acctopup_id"].ToString());
        _lvi.SubItems.Add(count.ToString());
        string date = reader["date"].ToString();
        _lvi.SubItems.Add(reader["date"].ToString());
        string account = reader["clientno"].ToString() + "(" + reader["firstname"].ToString() +
" " + reader["surname"].ToString() + ")";
        _lvi.SubItems.Add(account.ToString());
        _lvi.SubItems.Add(reader["paymentdescription"].ToString());
        _lvi.SubItems.Add(reader["amount"].ToString());
        _lvi.SubItems.Add(reader["receiptno"].ToString());
        lsvaccountopup.Items.Add(_lvi);
        count++;
    }
    reader.Dispose();
    cmd.Dispose();

```

Validation

```

if (Global.ValidateTextBox(txtaccount, "Account") == false)
    {
        return;
    }
if (Global.ValidateComboBox(cbdescription, "Description") == false)
    {
        return;
    }
if (Global.ValidateTextBox(txtamount, "Amount") == false)
    {
        return;
    }
if (Global.ValidateTextBox(txtcash, "Amount Tendered") == false)
    {
        return;
    }
if (Decimal.Parse(txtamount.Text) > (Decimal.Parse(txtcash.Text)))
    {
        MessageBox.Show("Amount Tendered can no be less than:(" + txtamount.Text + ")",
"CUT DH System", MessageBoxButtons.OK, MessageBoxIcon.Information);
        return;
    }

```

How to call a crystal report

```

rptStatement rpt = new rptStatement();
rpt.SetDatabaseLogon("root", Global.conPassword);

```

```
rpt.RecordSelectionFormula = "{st.client_id}=" + acc_id + " and {st.date}>=(#" +  
Global.startdate + "#) and {st.date}<=(#" + Global.enddate + "#)";  
TextObject st;  
st = (TextObject)rpt.ReportDefinition.Sections[1].ReportObjects["txtstatement"];  
st.Text = "Statement from: " + Global.startdate + " to: " + Global.enddate;  
  
TextObject sta;  
sta = (TextObject)rpt.ReportDefinition.Sections[1].ReportObjects["txtstart"];  
sta.Text = Global.startdate;  
  
TextObject star;  
star = (TextObject)rpt.ReportDefinition.Sections[3].ReportObjects["txtstart"];  
star.Text = Global.enddate;  
rpt.PrintToPrinter(1, false, 0, 0);  
rpt.Dispose();
```