Abstract

Technology is changing rapidly and there is need to adjust so as to improve the economy and how businesses operate in Zimbabwe. This research gives a detailed overview of the Pick n Pay Self-Service Mobile application with the main thrust of solving the problems of having long queues customers waiting to pay up goods, customers spending much than they have budgeted and increase in stationary costs during business operation, at the same time with the main of implementing new technologies in Zimbabwe that will help improve our economy through the improvement of business operations. The system will enable customers to purchase groceries through the scanning of barcodes using android smart phones and a virtual receipt being generated soon after payments of commodities. The system has a windows based application that will be used for the creation of account and product pricing by the internal users of Pick n Pay stores, and also it has a mobile application that will act as an interface between customer and the system resources. Researcher used interviews, questionnaires and observation scorecards as methodologies to acquire information that would help in system development. A windows based application was developed using CSharp programming language while the mobile application was developed using java. Major reason for carrying out the research is to curb the problems of the current system highlighted above at the same time increasing organizational sales.

Declaration

I, RUMBIDZAI RASHEL MASVINGISE, do hereby declare that l am the sole author of this thesis. I authorize Midlands State University to lend this dissertation to other individuals and institutions for the purpose of scholarly research.

Signature_____

Date_____

Approval

The dissertation entitled “Pick n Pay Customer Self-Service Mobile Application” by Rumbidzai Rashel Masvingise meets the regulations governing the award of the degree BSc Honors degree in Information Systems by the Midlands State University. It has been approved for its contribution to intellectual knowledge and literal presentation.

Supervisor_____

Date_____

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So much thanks to the Lord Almighty, who has always been the shield and the route to which l followed to reach this far in life, my soul will always magnify his name. And also my sincere gratitude goes to my supervisor Mr P. Denhere for his support and guidance throughout my project research. I would also want to thank the Pick n Pay holding team for their unwavering support in my research since they assisted me with all the information l required. Special thanks to my group members Wellington Mandizvidza, Kudakwashe Jena, Sandra Chiraga, Emmanuel Mdhlongwa and Beauty Musemwa, they have been so supportive in terms of advice, ideas and assistance. The team spirit made us pull through with that vision of success and our motto “what others can do, we can do better” has made us reach were we are today. My gratitude also goes to my Uncle Mr P. Mupfiga, he has always been my mentor and made me believe that nothing is impossible so long you work hard and nothing can ever be a barrier to success. Finally all thanks goes to my father and mother for all the sacrifices they made with the sole aim of making me successful as far as education is concerned. I greatly appreciate, may the Almighty bless you.

Dedication

I would want to dedicate this to my lovely and caring Mother, Mrs V. Masvingise, words alone cannot show how much l appreciate your efforts but the grace of God shall be with you always and my prayers will always be to wish the best for you. You were my pillar of strength when l was weak and your advices made me reach this far. My love for you will never fade and the Lord will continue blessing you abundantly for all your good works**.**

TABLE OF CONTENTS

List of acronyms

Php	Hypertext Preprocessor
SQL	Standard Query language
CBA	Cost Benefit Analysis
ROI	Return On Investment
Sms	Short Message Service
DFD	Data Flow Diagram
ER	Entity Relationship
EER	Enhanced Entity Relationship
SDLC	Software Development Life Cycle

List of Tables

List of Figures

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Technology is changing rapidly in the world of today and it is of paramount importance for an organization to find ways of improving customer support service facilities with an attempt of being the best service providers at the same time being the world's best market as compared to its competitors. The purpose of the study is to give an introductory lineup with the main intention of the development of an online customer self-service mobile application for Pick n Pay stores. It is an automated system with the main thrust of improving organizational efficiency through quality and instant service to its customers. The chapter will highlight the background of the research, problem definition, significance, objectives, and hypothesis together with the justification to system development.

1.2 BACKGROUND OF THE STUDY

An analysis was made concerning the operations of the activities of Pick n Pay starting from the time a customer enters the shop till he or she queues at the till to make payment and also, the behavior of the managerial in system maintenance and updating. After all has been done, an online customer self-service mobile application was found to be the best alternative to reducing the level of congestion in the store and at the same time avoiding an over budget to the valid customers. Instead of strenuous data base maintenance and system monitoring the self-service application will save the self-monitoring purpose to both the organizational personnel and its customers.

1.2.1 Organizational Background

Pick n Pay is an investment holding company with sole purpose of controlling shareholdings of Pick n Pay stores. It operates in the retail sector and its major focus is on the customer. The founder was Raymond Ackerman who spread his works in various parts around Africa. Major concern is on groceries, clothing and merchandise, including value added services to cater for the customer's desires. It aims at doing things that help its customers and community by providing affordable and quality food stuff. As a result of doing well in business, efficiency and customer sovereignty Pick n Pay has grown rapidly for the past years.

1.2.2 Organizational Structure

The organizational structure shows the relationship between members at Pick n Pay, their positions and line of formal communications. This is shown in the figure below:

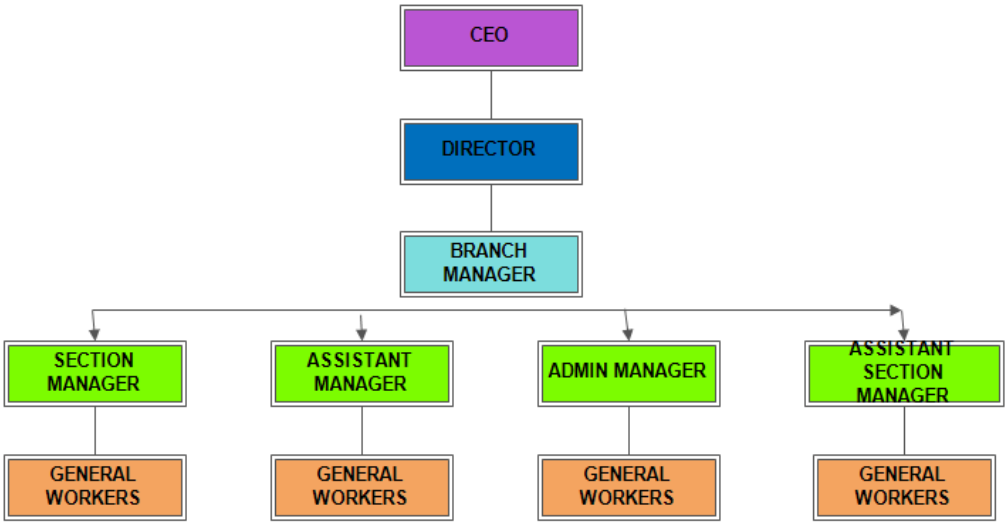


Figure 1.1: Organogram

1.2.3 Company Vision

To support and encourage Africans to be sole providers and focus on improving their lives and be contributors to the community.

1.2.4 Mission Statement

Serving our clients wholeheartedly and creating a favorable environment for them. Through the use of our mindset, an admirable place to shop is created.

1.2.5 Company Values

- Passionate about customers will
- Supporting customer rights.
- Respect and care for customers and personnel.
- Focus on personal growth and opportunity.
- Reward innovation and nurture leadership.
- Integrity and honesty at all cost.
- Participate and Support in the community.
- Responsibility as an individual at all aspects.

- Accountable for any issues at hand

1.3 PROBLEM DEFINITION

The current retail system uses the conventional system:

Customers visit the shop and collect required goods in a basket and then visit the till where the goods are paid for. This process has got the following challenges:-

- Some customers may pick up goods above their budget and this can only be discovered at the till.
- More time is used during the input of the goods on the till and this increases queues.
- Stationery costs are higher since it involves printing of receipts.

1.4 PROJECT AIM

The major aim of the research is to develop a customer self-service application for Pick n Pay that enables customers to scan products bar codes, get the price, send payment online, generate a receipt and walk out without having to queue for payments.

1.5 OBJECTIVES OF THE STUDY

The objectives of the study it to design a mobile application that:

- Allows customer self-service where by a customer through a smart mobile device will add goods in a virtual basket, manage the basket, add to and remove product from the cart.
- Enables the viewing of the goods bought and make a payment through the mobile device using WIFI.
- Interfaces the customer self-service mobile application to the windows application so that the goods purchased by the customer are updated in the inventory database.
- Makes it possible for the Sales Manager to be able to add manage products, create and manage customers, create and manage users.
- Display reports which include sales reports and customer's reports.
- Improve Customer Relationship Management by showing high spending customers and rewarding them.

1.6 INSTRUMENTS

- **JAVA -** It is an object oriented programming language that will be used for the Mobile Application.
- **C# -** It is a programing language that will be used for the desktop application.
- **Sql Server –** this will work as a database to which the project will be created and will work as a storage repository where data will be retrieved.
- **IIS – Webserver –** this will be used to host web services.

1.7 SYSTEM JUSTIFICATION

- **Reduction of costs of labor**

  Instead of the till operators working on tills saving customers, their works will be replaced by the customer due to the presence of the self-service application.

  Customers who prefer being helped by the cashier can still have the privilege to do so and those who are not interested can opt for self-checkout.

- **Self-service does not use up a lot of space**

  Customer transactions are easy to control and monitor since all is done at the back end hence less space is occupied since many shops can be placed in a small area and monitored.

- **Efficiency and Speed of Checkout**

  Speed in service is increased since customers just scan bar codes and pay using a virtual debit card instead of having to wait in long queues to be served by the cashier.

- **Less Subordinates to pay**

  Instead of paying many cashiers and increasing organizational costs, especially when a few customers are using the tills, it will be of paramount importance to flatten the cashier team since less or no work at all is done hence reducing salary costs.

1.8 SYSTEM FUNCTIONALITY

- The customer is going to be registered for a mobile application account by the administrator and provided with a card number which will be linked to the Pick n Pay Shop easy shopping voucher debit card.

- Customer provides funds which will be loaded into in the card by the administrator.
- The customer will then register his card on the mobile application and once registered the customer can begin shopping
- Using a camera phone a customer scans bar codes of products and add them in the virtual basket, the same product is also placed in the physical basket or cart generating product's cost.
- The mobile application basket gets updated with each product added or deleted from the basket and it must provide a customer with the current balance of goods selected.
- The customer makes a payment for the goods which must deduct the balance deposited at first by the customer.
- A virtual receipt must show on the application and SMS notification sent to customer.

1.9 CONCLUSION

Focus was on highlighting an introduction involving giving a brief outline on the company's history, identification of the problem and possible solutions to the problems. The methodologies to be used were outlined together with a clear justification to support the proposed idea in problem solving. We then move on to the next chapter were we will look at the visibility and viability of the proposed project to see if it is worthy doing.

CHAPTER TWO: PLANNING PHASE

2.1 INTRODUCTION

Planning involved the developer understanding the costs of carrying out the study in relation to the benefits the system is intended to provide. Stoner (2001) defined planning as an act of formulating a program. Feasibility study looks at the organizational business value and the percentage to which the project is going to increase the value of the business and its operation. It performs the appraisal to evaluate the worthiness of carrying out the project. Basically it looks at:-

- Why we should build the system
- Identifying the business value
- Feasibility analysis
- Projects work plan

All activities of the study are directed to answer the question, Should we proceed with the project? And the planning phase will help us answer in.

2.2 REASONS FOR BUILDING THE SYSTEM

The main aim of the development of the proposed system was due to the identification of the problems in use of the current system. Below are the various factors that justify why we should develop a self-service application:-

- It will help reduce labor costs since one attendant can often run four to six checkout lanes with the work of the cashier now being assumed by the customer. Customers who do not want to interact with the cashier or be a part of the queue where the current customer and cashier are conversing can now use the self-checkout to avoid those situations.
- Efficiency and Speed of Checkout is increased, instead of dealing with long lines that get backed up by customers waiting to pay, people can quickly make purchases by scanning items themselves.
- Self-Checkouts take up less space because multiple kiosks can be placed into a relatively small area, stores can take care of customer transactions with minimal space

- Fewer employees to pay since cashiers aren't completing any tasks and are essentially being paid for nothing due to the availability of the self-service application.

2.3 BUSINESS VALUE ANALYSIS

According to Sward (2006) business value is a term that includes forms of value or benefits that determine the health and wellbeing of a firm. In this section we will identify the value of the proposed system to various entities and we will also assess the positive and negative impact of the proposed system in relation to the current system.

2.3.1 Customer Value

Since customers would have taken over the cashier position, time spent waiting in long queues is reduced since one can now self-serve. At the same time impulse buying is reduced since customers view the catalogue of existing products and they buy according to the budget of moneys available in their virtual cards. Advertisement and promotions are viewed online without having to visit Pick n Pay stores. An online solution means there is no time limit or a specific location for information access hence promoting cost reduction of travel to customers.

2.3.2 Channel Partner Value

A channel partner is a company that partners with another organization or producer to sell its products. Examples of Pick n Pay channel partners are Lyons, Dairiboard, Lobels, Irvines, Lever brothers and many others. These also benefit from the use of the system in various ways. Business efficiency is increased through product disposition and brand advertisement since all updates are made known to customers at any given time so long they have the application installed on their mobile phones. Products of channel partners are sold quickly and this making it possible for them to supply more commodities.

2.3.3 Employee Value

Since the customer will reduce the interaction between employees and the customer, the system is designed to meet a greater number of ever increasing customers therefore repetitive customer service and delegation levels are reduced.

The proposed system will enable system synchronization, capturing of customer comments and also purchase behavior patterns of customers hence helping them in segmenting the market hence, improving profit margins and motivating employees.

Employee skills will be improved since training will be conducted to manage and maintain the system and less effort will be required.

2.3.4 Managerial Value

The implementation of a customer self-service application will help reduce employment rate and will also flatten the organizational structure. Therefore instead of long hierarchical levels, the system becomes a supplement for efficiency and productivity of the organization. And also, instead of monitoring many employees or cashiers on how they are performing, the customer becomes a 'cashier' and the management only plays a role of monitoring systems and digital receipts of customers.

2.4 FEASIBILITY STUDY ANALYSIS

Feasibility study analyses the practicality of a customer self-service application assessing the possible pros and cons attached to it if we were to implement it at Pick n Pay. According to Hall (1962), feasibility study is a report that leads to a choice of one amongst two or more alternatives. It evaluates the various reflections that lead to particular perceptions in decision making. Feasibility study formalizes the openness of brainstorming process. In feasibility, the problem is carefully described, risks are looked at in relation to the proposed system. Later, decisions on what to accept are influenced on the outcome of the feasibility study. In many cases, in the form of an impact assessment statement, feasibility study provides the basis for action by funding agencies. A well done feasibility study should give a decision on whether further action is desirable and should be able to convince others as well.

2.4.1 Technical Feasibility

Processor	Pentium 4
Ram	512mb Or Better
Cache	512mb
Hard disk	50gig

Table 1: Client Computer Specifications

Operating System	Windows 7/8/10
Server Side	IIS Web Server
Client Side	Html, Java Script
Client Side Scripting language	Java Script
Services	JSON REST Web Services
Database	Ms Server
Programming Language	Java, C#
Web Applications	Asp.Net
IDE/ Workbench	Eclipse

Table 2: Software Specifications

2.4.2 Economic Feasibility

Economic feasibility analysis help analyze the positive economic benefits to be provided by the proposed system to the organization. Assessment usually involve cost and benefit analysis and the business case analysis. If the costs outweigh the benefits then the project will be put to a halt. It will also have a look at tangible and intangible benefits, development and operational costs and the time taken to recoup the initial capital invested if project is to be developed.

2.4.2.1 Business Case Analysis

Business case assesses the environment to which the business is running. It also takes a further look at the business nature, customer type, current payment process and expected time required to perform a transaction. Analysis of the business case done by Pick n Pay helped identify the benefits that are to be gained through the implementation of the proposed project. It also gave the organization a platform to reason upon the economic feasibility assumptions stated hence obtaining the advantages and disadvantages of implementing or not implementing the system**.**

2.4.2.2 Cost Benefit Analysis

This gives an assessment of the costs and benefits that are to accrue if the system is to be implemented. In actual sense, costs should not outweigh benefits. However if this eventually happens, the project will be said to be not feasible. Some of the benefits will not be in monetary form therefore, these are to be converted into monetary form so as to have clear figures for proper analysis and comparison. This will help the organization to see if they are financially strong to proceed with the proposed project from the development up to the maintenance phase.

2.4.2.2 Tangible Benefits

- Reduced calculation and processing errors
- Reduction in financial loses
- Improved productivity and efficiency
- Improved information availability and accuracy
- Reduction in communication hierarchy

The table below will outline the estimated tangible benefits in monetary terms:-

Annually expected tangible benefits	**(US$) Amount**	**(US$) Total**
Reduced calculation and processing errors	3 000	
Reduction in financial loses	3 500	
Improved productivity and efficiency	1 000	
Reduction in communication hierarchy	800	
Information availability and accuracy	5 000	
Expected annual benefit		**13 300**

Table 3: Tangible Benefits

2.4.2.3 Intangible Benefits

- Technology diversification and appreciation
- Improved decision making capabilities

- Increase in information quality
- Increase in staff motivation and morale
- Increase in customer loyalty
- Increase in competitive advantage due to service differentiation

Annually expected intangible benefits	**(US$) Amount**	**(US$) Total**
Technology diversification and appreciation	1 500	
Improved decision making capabilities	1 500	
Increase in information quality	3 500	
Increase in staff motivation and morale	500	
Increase in customer loyalty	900	
Increase in competitive advantage due to service differentiation	4 000	
Expected annual benefit		**11 900**

Table 4: Intangible Benefits

2.4.2.4 Cost Of Development

These are the estimated costs to be accrued during the development process. These are to be estimated before the project begins basing on the phases to be followed up to project completion. These are shown below:-

- Development team
- Staff training
- Equipment
- Customer awareness
- Information supply
- Installation

The table below shows the development costs in monetary terms:-

Annually expected development costs	**(US$) Amount**	**(US$) Total**

Development team	4 000	
Staff training	1 500	
Development equipment	1 000	
Customer awareness	500	
Information supply	1 000	
Installation	2 000	
Expected annual costs		**10 000**

Table 5: Expected Development Costs

2.4.2.5 Operational Costs

These are costs that are incurred in the daily operational use of the system. These costs are divided into fixed cost (those that are not directly linked to production and remain the same) and variable costs (those that are directly linked to system performance and use). These cost estimates will be shown in the table below:-

Annually expected operational costs	**(US$) Amount**	**(US$) Total**
Server upgrade	600	
Backup plan	300	
Conversion costs	1 200	
Software upgrade	700	
System maintenance	500	
Training costs	1 300	
Expected annual cost		**4 600**

Table 6: Expected Operational Costs

2.4.2.6 Overview Of Cost Benefit Analysis

This will show the overall benefits and costs of the proposed project that will lead to the decision of whether the project is viable or not.

Cost and Benefit	**(US$)Amount**	**(US$) Amount**	**(USD) Amount**

COSTS			
Development costs	10 000		
Operational costs	4 600		
Total Costs			**(14 600)**
BENEFITS			
Tangible		13 300	
Intangible		11 900	
Total benefits			**25 200**
NET BENEFITS			**10 600**

Table 7: Cost Benefit Analysis

2.4.2.7 Return On Investment

Return on investment is a performance measure used to evaluate an investment efficiency or comparing the efficiency of a number of different investments. It measures the amount of return to an investment cost. It is measured as a percentage. In this case the researcher will do a 3 year comparison using Return on Investment and is calculated as:-

$$\text{Return on investments} = \frac{\text{Net benefits}}{\text{Total costs}} * 100$$

	2015	**2016**	**2017**
COSTS	10600	11000	12600
BENEFITS	14600	14000	13500
ROI	**72.6%**	**78.6%**	**93.3%**

Table 8: Return On Investment

Explanation on statistics

The estimated costs and benefits from 2015 to 2017 show that the return on investment of the project will increase as the project continues to be in use.

2.4.3 Social Feasibility

Analysis revealed that, the proposed system will impact the society both positively and negatively.

POSITIVE IMPACT

- To those who are more technical, it will help them reduce burdens of waiting long queues and all that they do will be done on time since they will be serving themselves.
- Those who are in possession of smart phones become smarter by being able to use their gadgets for a more unique task of shopping for them.
- The system will act as a wallet to the customers that will help them budget for their groceries at any given time since it gives a platform of advance deposit in the virtual debit card.

NEGATIVE IMPACT

- It will be a great disadvantage with those without smart phones, they will feel as if they are behind as compared to the others and might feel as if they do not fit buying from there.
- Some individuals are computer illiterate and some are old and will not have the privilege to have a feel of the system.

SOLUTION

It will be of paramount importance to do a parallel implementation of the system so as to make sure that most, if not all of the customers are used to the system before a direct changeover strategy.

2.4.4 Operation Feasibility

For a system to be operationally feasible, there should be total support and involvement from stakeholders throughout the project so as to be rest assured that there is operational understanding of the system. This will also lead to the positive acceptance of the system to Pick n Pay and users will definitely support in every way. The system will help the following users in various ways:-

2.4.4.1 Operations Management

The operations management team were in full support of the project since they had the view that it will improve business operation and efficiency instead of people spending much time waiting in long queues. So due to the availability of the mobile application, customers can now save themselves without much pressure at any given time. They also assured that they will convince the rest of the organizational team on how vital the proposed system will be to the organization.

2.4.4.2 Sales Management

The sales management was greatly impressed with the proposed system since they have the view that the system will increase their sales margin. This is so because customers want easy shopping ways therefore by just getting into a shop and buying using your mobile phone it becomes easier at the same time the system will help customer budget since they pay in advance and by using their virtual debit cards, they automatically deduct their amount as they purchase hence reducing cases of losing their moneys or theft crimes.

2.4.4.3 Finance Management

These were much concerned about the benefits that the company will get by implementing the proposed system. They viewed it as if the resources required to set up the new system would cost more than the current operations but after some further elucidations they did agree that, the proposed system will reduce employment costs, and costs of having expired goods in store since all the operations will be automated from the top management up to the customer.

2.4.4.4 Organizational Staff

The effectiveness of the system came to being after realizing that the system will reduce routinely and monotonous tasks that will end up demotivating employees. Therefore, the self-service mobile application will reduce the work load on employees since they will have few people without smart phones or that are comfortable with the traditional way of purchasing to attend to.

2.4.4.5 Customers

Most customers supported the system since they viewed it as a time conscious aid. Less labor will be required for them each moment they got in store and also payment in advance is a better way of budgeting according to their view.

2.4.4.6 ICT Management

They were greatly impressed with the idea because instead of them monitoring multiple systems, the self-service application will act as an umbrella system in business operations and any

changes can be done easily without having to visit any till hence making them concentrate on other better tasks.

2.5 RISK ANALYSIS

2.5.1 Market Risk

The brand, compliance and market exposure is determined by the system performance therefore failure to comply to meet customer demands will have an impact on the suppliers or channel partners of Pick n Pay. Therefore if the system fails to deliver updates to customers completely, they will be looking forward to explanations from the organization thereby having an impact on the marketing strategy of the organization.

Mitigation and Management

Determine the possible impact of compromise and find a backup plan in case of system poor performance. Monitor the marketing lines so as to detect early warnings that might impact the firm's goodwill and brand.

2.5.2 Performance Risk

This involves system performance in relation to ongoing supplier quality and financial issues. Failure of system to work according to plan or failure of system to meet business objectives may reduce organizational performance hence leading to an increase in costs, and at the same time failure of customers and employees to use the system affects the ongoing performance of the business.

Mitigation and Management

Continuous monitoring of system performance is required to avoid disruptions. Training and awareness should be conducted to both employees and customers before system usage. Constant vigilance is needed.

2.5.3 Implementation Risk

System implementation can lead to production and performance ramp if implemented before full understanding of system performance by employees and customers.

Mitigation and Management

Instead of a full implementation of the system, it would be wiser to do a parallel implementation of the system. As some use the old way of procurement and payment, others will be familiarizing

with the self-service application and they are fully familiar then a direct implementation can be done. This will make customers feel comfortable to purchase at Pick n Pay hence maintaining customer loyalty.

2.6 DEVELOPMENT OF A WORKPLAN

Task	Start date	Completion	Duration
Project proposal	03/08/2015	09/08/2015	1 week
Planning phase	10/08/2015	23/08/2015	2 weeks
Analysis phase	24/08/2015	06/09/2015	2 weeks
Design phase	07/09/2015	27/09/2015	3 weeks
implementation	28/09/2015	04/10/2015	1 week
Evaluation	5/10/2015	11/10/2015	1 week
Documentation	03/08/2015	11/10/2015	10 weeks

Table 9: Workplan

2.6.1 GANTT CHAT

A Gantt chart is a representation of the project schedule that is the start and finish dates of the different phases of development.

Activity/period(weeks)	1	2	3	4	5	6	7	8	9	10
Proposal										
Planning phase										
Analysis phase										
Design phase										
Implementation										
Evaluation										
Documentation										

Figure 2.1: Gantt chart

2.7 CONCLUSION

After the project had been deemed viable, the researcher is now able to move to the design phase. A work plan has been made and tasks are to be done within the stipulated time. Analysis has been done to the current system and further more will be looked at in the next phase.

CHAPTER THREE: ANALYSIS PHASE

3.1 INTRODUCTION

Feasibility study showed us the costs and requirements of the proposed system. Analysis phase answers the questions of who will make use of the proposed system, how the system will work, and where and when it will be implemented (Dennis, 2002). Analysts will work with the users to find out the user requirements and expectations to the proposed system. Output of the analysis phase will give a brief outline of the analyzing team's alternative recommended solution in line with user requirements. Once recommendation has been accepted then system design will begin. (Hoffer, 2002). This phase will look at the current system functionality, process flows involved and their coordination. The main functionality of the current system will be analyzed together with the inputs, processes and outputs.

3.2 INFORMATION GATHERING TECHNIQUES

Information gathering is done so as to get a realistic view of system functionality from various stakeholders who are directly and indirectly involved in system use. An information gathering methodology provides with a sequence of steps involved in order to come up with the requirements. Researcher made use of three fact finding techniques which are:

- Interviews
- Questionnaires
- Observations

3.2.1 Interviews

An interview involves a conversation between two people, which is the interviewer and the interviewee in order to acquire information pertaining to a certain topic of discussion. The manager, sales representative and customers of Pick n Pay were interviewed so as to gather some information. And main focus was on:-

- locating the respondent
- persuading them to answer questions
- asking questions
- recording answers
- ensuring answers are meaningful
- Ensuring the answers are the respondents' own.

There are two types of interviews which are structured and unstructured interviews.

3.2.1.1 Structured Interviews

A standardized (or structured) interview involves a procedural activity in which the same question is asked exactly the same way and in the same order (Artkinson, 1964). Researcher used this approach to interview mainly customers so as to get a clear view of different perceptions of different customers towards the services they are being offered at pick n pay stores. This helped in coming up with a qualitative and quantitative analysis of the views in relation to the information being researched on.

3.2.1.2 Unstructured Interviews

Open ended interviews have no formal structure. Questions are asked in the same order and there is room for discussion between interviewer and interviewee. This is normally done on topics which are broad and require discussions. Researcher used this approach while interviewing the management team and the ICT department. This was to help the researcher to have a broader view on how the system operates and various defects the system holds. Giving room for discussion also helped the management team to understand how the proposed system will operate and if it will help increase organizational sales hence being deemed feasible.

3.2.1.3 Advantages Of Interviews

- It enabled the interviewer to examine the posed topics hence having an in depth of the required information before having to answer and also it gave room for discussion hence making it more interactive between Pick n Pay personnel and the interviewer.
- Asking the same questions in the same manner helped analyze the responses and makes it easier to replicate discussion hence making it easier to regulate.

- The use of interviews as a methodology made it easier to analyze how customers feel about the services being offered and what they feel should be improved on the system performance. Airing out of views was impressive since discussions where done and individuals felt comfortable to take part.

3.2.1.4 Disadvantages Of Interviews

- It was time consuming especially in the case of unstructured interview because every individual wanted to stress his or her view about the system.
- Some managerial members and customers where not willing to spare their time and take part because they were in a hurry.
- Quality of information gathered is determined by the quality of questions therefore, not all that was required was gathered by this methodology.
- Preplanning wasn't taken into consideration by the researcher hence some questions where just asked as the interview was progressing having an effect of ending up discussing irrelevant stuff.

3.2.1.5 Findings From Interviews

Researcher interviewed various stakeholders both internal and external and analyzed their views toward the current and proposed system. She realized that to some Pick n Pay customers, the current system was more favorable and understandable as compared to the proposed were as some saw it as a huge step to innovation that will reduce the burden of long queues. Basing on the customer survey, the sales management agreed to the system since they foresee it causing a rise in sales figures as compared to that of the current management. However some of the members of the management team continued to stress out that the current system was the best for them and the top management was impressed with the functionality of the proposed system.

3.2.2 Questionnaires

Bell (1999) states that a questionnaire is a structured series of questions used for data collection which are given to respondents so as to provide the answers. Such a methodology is used in areas where individuals have no time for interviews and when anonymity is greatly required. Questionnaires are used to collect both qualitative and quantitative data that will be used for statistical analysis. There are two types of questionnaires which are open ended and closed ended.

3.2.2.1 Open Ended Questionnaires

These are questions that require answers with explanations and are normally associated with the questions why or how. These are normally used so as to collect full data pertaining to a certain topic of interest therefore interviewee has more room to explain to the fullest.

3.2.2.2 Closed Ended Questionnaires

Closed ended questionnaires normally require the answers 'yes' or 'no'. Interviewee is given a number of questions and there are expected answers that he or she has to select from in a certain category. The outcome is easily converted into quantitative data.

3.2.2.3 Advantages Of Questionnaires

- Much information is collected within a short space of time since questionnaires are just issued over a large scale then collect after being filled.
- Employees were given much time to answer since during working hours they were busy therefore they filled in during their free time.
- Quantifiable answers are gathered through the use of this methodology
- Questions are planned accordingly ahead of time which is of a greater advantage as compared to the use of open interviews.
- Consultation to various people is done within a short space of time since questionnaires are distributed at random hence the methodology can be more efficient.

3.2.2.4 Disadvantages Of Questionnaires

- Some information was distorted due to emotions and behavior of an individual towards a certain topic and also fear to expose important company information.
- A limited amount of information was gathered since there was no room to ask questions in order to understand before filling in the questionnaire.
- People read and understand differently to each question hence ambiguity of answers is highly possible.
- There is a high level of subjectivity.

3.2.2.5 Findings From Questionnaires

From the findings of the questionnaires researcher realized that she was developing the questionnaire basing on her personal assumptions and decisions as to what is and is not important hence missing some of the important research aspects. This was realized due to some of the answers that where generated from the open ended questionnaires that provided with very

important aspects that were not included. But however some of the answers were ambiguous and others did not return the questionnaires. To those who took part in answering, important information that was not known by the researcher was made known through analysis.

3.2.3 Observations

Kopper (1959) states that observational or field research is whereby researcher monitors ongoing behavior. It involves analyzing frequency of system usage, number of people accessing system services and ascertaining busy and quiet times

3.2.3.1 Participant Observation

In this type of observation, the observer is fully participating in all activities. Participation includes working in the area of concern together with the people in the department of interest until the observer is deemed an accepted member in that area of interest.

3.2.3.2 Non Participant Observation

In this type of observation, observer is more like an eavesdropper. She will be analyzing actions and activities without having to interact with the group and the group should not notice that they are being observed. Actions are noted as they occur and are then further analyzed to come up with required information.

3.2.3.3 Advantages Of Observations

- Data collection is direct and it assists in analyzing human behavior in relation to system usage.
- Accuracy can be assured especially in the use of participant observation.
- There is a reduction in dependency on respondents since there is direct interaction.

3.2.3.4 Disadvantages Of Observations

- Past events and historic data cannot be observed.
- Opinions and attitudes cannot be studied when only observing.
- It is time consuming since an action has to be done first before concluding and recording.
- Observing alone as a methodology cannot provide with solid information pertaining to a given subject of interest.
- Important activities can be done during odd times thereby having a disadvantage to the researcher.

3.2.3.5 Findings From Observations

Due to the fact that observations were normally done during the day most of the results could not be observed since during the day all will be busy. At the same time, report compilation took time because it is hard to just conclude by merely analyzing a single action moreover, the reports can also be biased because once someone notices that he or she is being observed a biased action can be portrayed. Observation was done in a period of 4 days therefore it's not known if the system was running smoothly during those days and a breakdown eventually occurred in days after the research.

3.3 ANALYSING THE EXISTING SYSTEM

System analysis involves analyzing the operations of the current system and noting the errors that might require system updates. Pick n Pay point of sale system starts with the sales manager entering barcodes into the system for available goods in store. Then customer enters the shop and selects goods required and put in the physical basket. Customer then goes in a queue that heads to the till to pay for the goods. Till operator scans the goods using a barcode scanner and these goods are recorded as bought and deducted from the system, total price is calculated and customer pays the amount. After payment has been done, the guard at the door checks receipt against physical goods for security purposes.

3.3.1 Inputs

- Grocery codes
- Amount paid
- Bar codes

3.3.2 Processes

- Scan barcodes
- Query commodity price
- Calculate change
- Generate receipt

3.3.3 Outputs

- Price and item name
- Amount changed
- Receipt

3.4 PROCESS ANALYSIS

According to business dictionary process analysis involves breaking down process phases that were used to convey the operations and outputs that took place at each phase of development. It helps us understand how each process operates and to see areas were improvement is required.

3.4.1 Activity Diagram

It's a stepwise approach that shows the actions and activities and how they iterate. They intend to mimic the organizational processes and computational processes. Overally it shows the control flow.

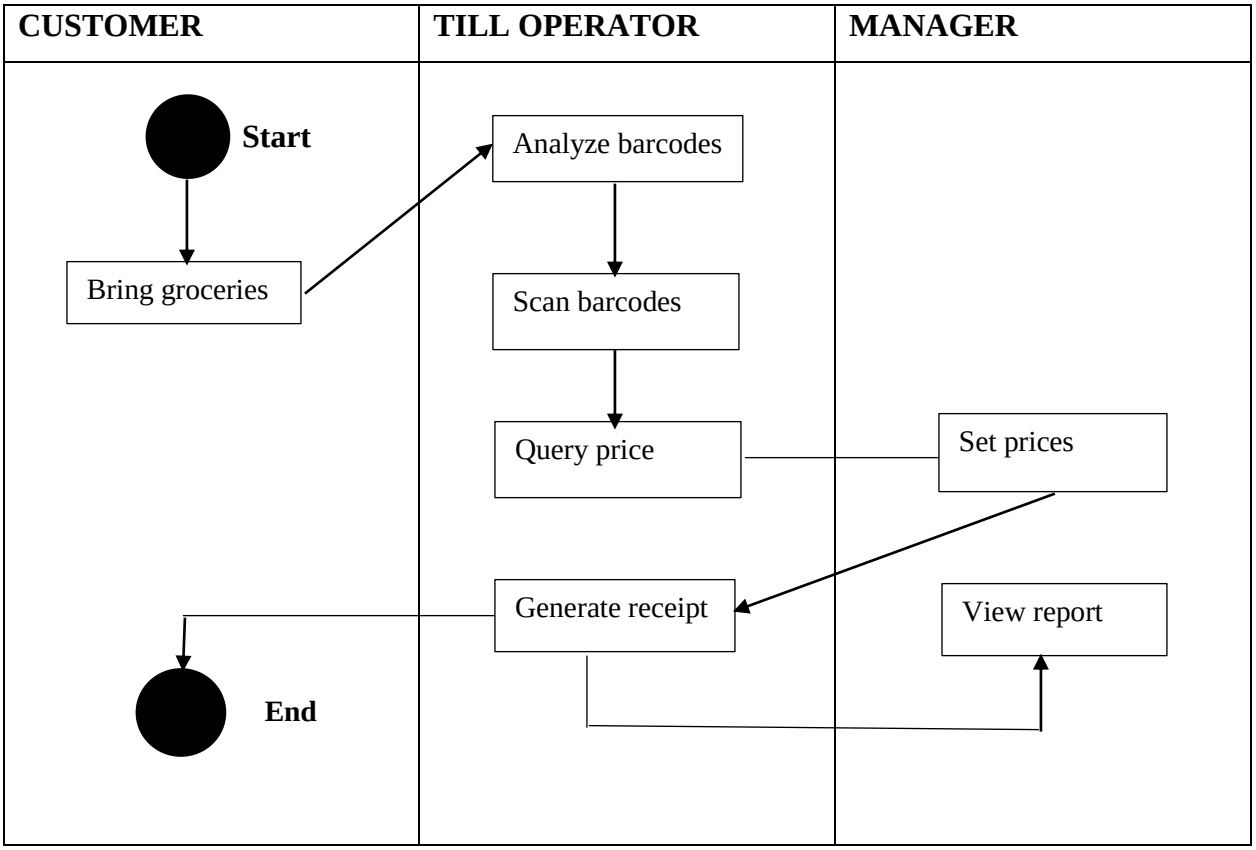


Figure 3.1: Activity Diagram For Current System

KEY:-

= process taking place **= Activity flow**

3.5 DATA ANALYSIS

Involves data evaluation through the use of logical reasoning and analyzing the data provided and come up with a solution. Data collected about the organization should be usable and valuable (Longnecker, 2008). Data analysis was represented in the form of a data flow diagram.

3.5.1 Context Diagram

A context diagram is a diagrammatic representation that shows the system as a higher level process. It also shows the relationship between entities and the system. Below is the current systems context diagram:-

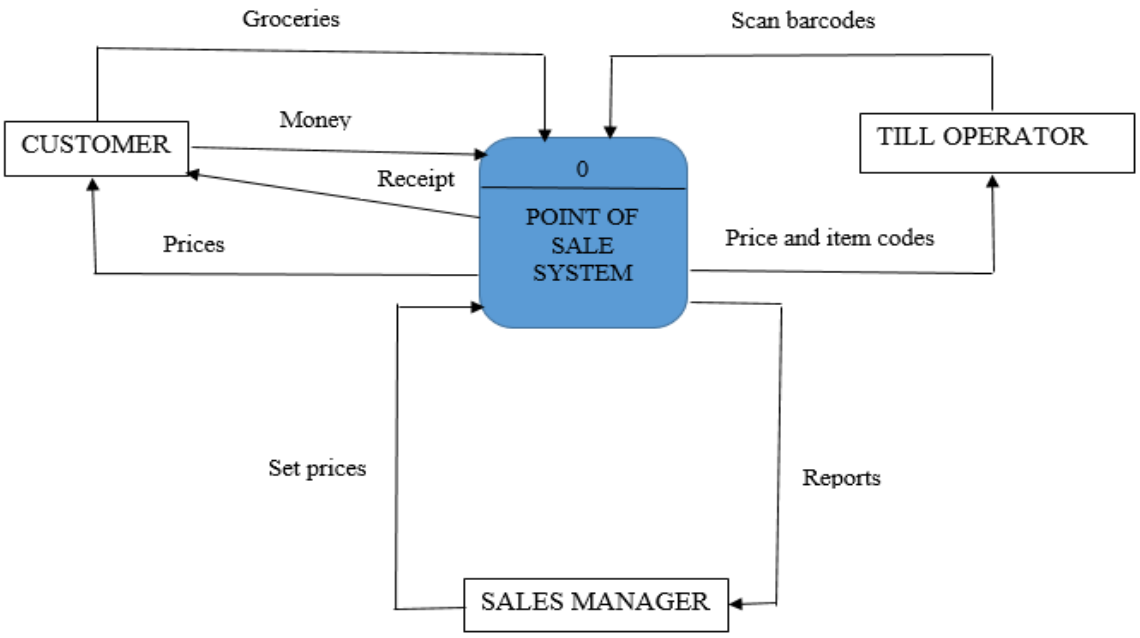


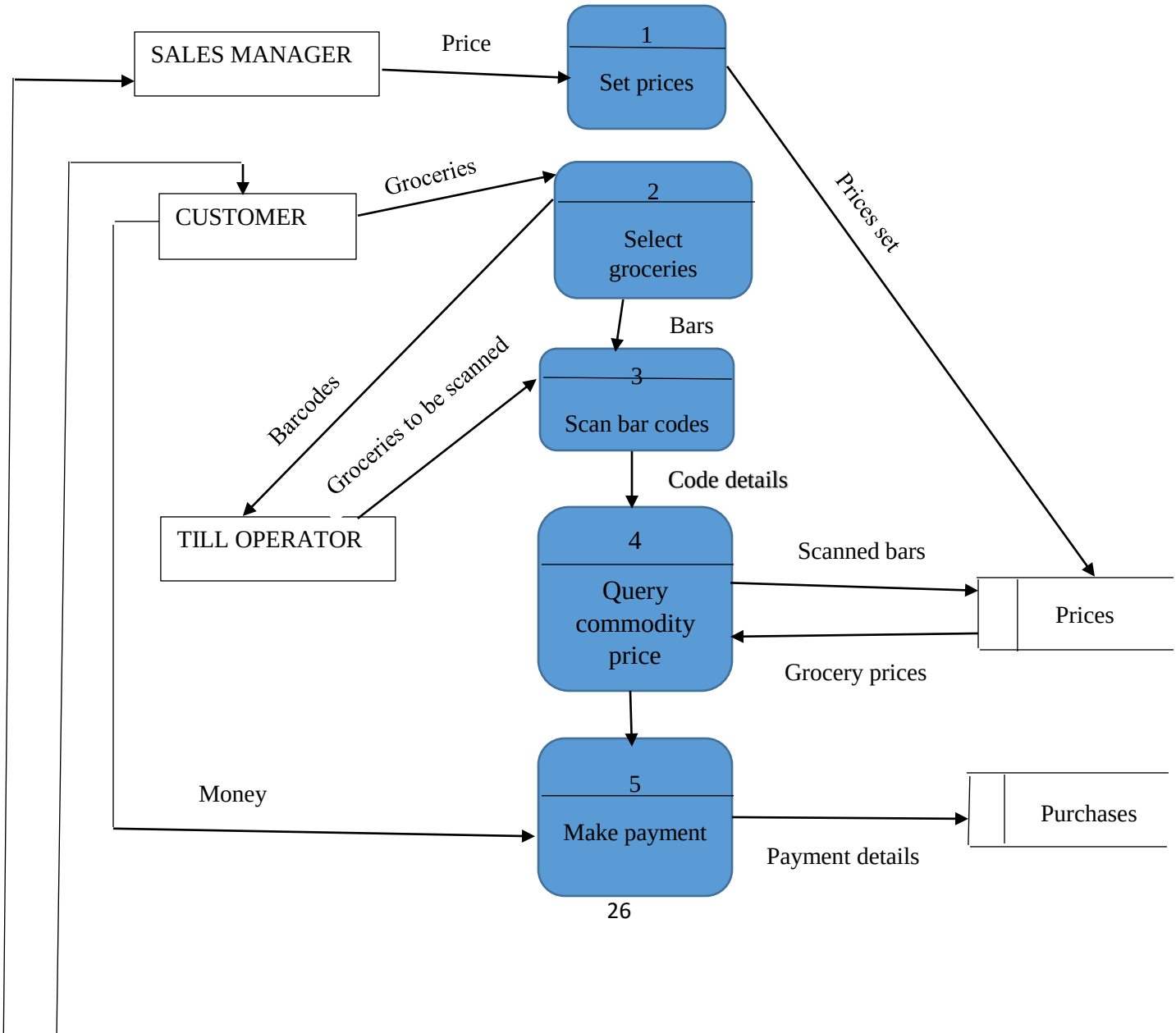
Figure 3.2: Context Diagram For Current System

KEY:-

= Entity **=System** **=Data flow**

3.5.2 Data Flow Diagram For Current System

A data flow diagram is a representation in diagrammatic form that shows how information flows and is exchanged in a system. Is describes the processes involved at each phase of system performance (Dennis etal, 2014). It starts from the entity inputs, then processes the data attained and is eventually given as output and stored in data stores.



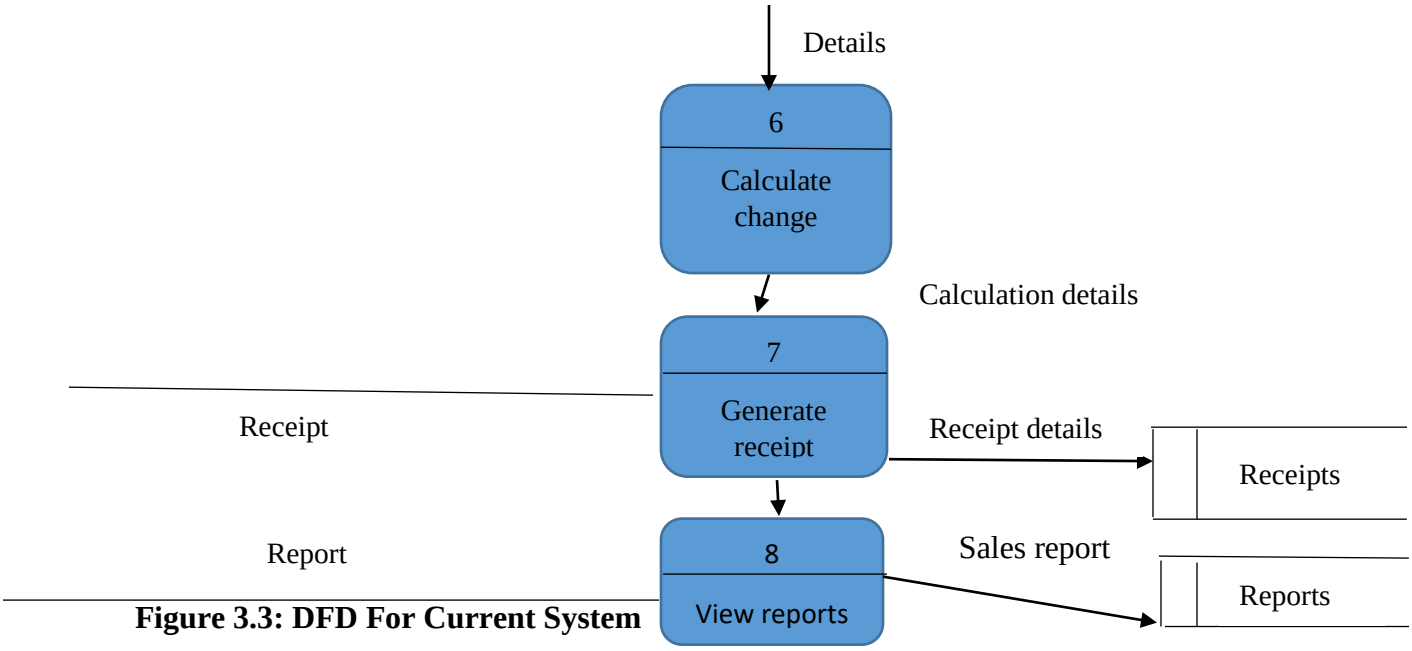


Figure 3.3: DFD For Current System

KEY:-

= Entity **= Process** **=data flow** **= data store**

3.6 WEAKNESSES OF THE CURRENT SYSTEM

Current system is conventional in the sense that:-

- Customer has to pick up items and join the queue in order to pay for items.
- System has slow processing capabilities in the event of many customers entering the shop to purchase.
- More time is taken in the process of punching figures on the till.
- High stationary casts since there is need to print receipts.
- Need to employ and train employees that will work as till operators.
- Prone to errors in the event of failure to instantly update the database or if the till operator punches wrong bar codes.
- There is repetition of processes. Hence reducing employee morale.

3.6.1 Strengths Of The Current System

- Reports on daily activities is clearly accessible.
- The system has strong authenticity in all its operations.

- Current system also shows the till operator who served customers at the current date and time hence making it easy to see activities done by each employee and it also becomes easier to see any errors done.

3.7 EVALUATION OF ALTERNATIVES

A number of alternatives were looked at as a means to identify the best that would minimize the problems identified at Pick n Pay. After gathering all the information the researcher presents the report and a meeting is held with the management who will there after decide on whether to outsource, improve or internally develop the system.

3.7.1 Outsourcing

Braggs (2006) states that outsourcing is a situation when a company decides to purchase services from an outside source instead of using personal resources and facilities to perform the same work. It involves weighing the opportunity cost of outsourcing services.

3.7.1.1 Benefits Of Outsourcing

- It can be a cost saving strategy if implemented properly.
- It helps them focus on other core competence activities rather than project development.
- It increases flexibility since other ideas and new technologies are outsourced.
- If the services are being provided by a professional company, it can lead to a higher competitive advantage.

3.7.1.2 Disadvantages Of Outsourcing

- There is poor quality control since almost all activities are controlled by the outsourced company.
- Project can be expensive and difficult to maintain in the long run.
- Organizational confidentially is exposed since the developing company will have access to some of the company information that will help them build the project.
- Outsourced company can teach competitors about the company system hence minimizing the firm's competitive advantage.

3.7.2 Improving The Current System

Pick n Pay might decide to upgrade the existing system with an attempt to improve services. Upgrade can be in the form of increasing employees or upgrade of computer hardware and software so as to reduce the lagging time that will lead to long hectic queues.

3.7.2.1 Advantages Of Improving The Current System

- It can be seen as a cheaper option since maintenance and upgrade is done by the internal stuff.
- In the event f just a hardware and software upgrade, there will be no need to increase personnel.
- No need for training expenses since there will be not much difference between current system and upgraded system.

3.7.2.2 Disadvantages Of Improving The Current System

- Current system is of a low processing speed therefore, even if upgraded there might be no change at all.
- The complexity nature of the current system may lead to complications in upgrading.
- Upgrade can also affect working hours hence may have an effect on sales.

3.7.3 In-House Development

Involves activities being operated internally in an organization instead of seeking assistance from an outside company (Seffah etal, 2006).

3.7.3.1 Advantages Of In-House Development

- It is important for speedy projects since internal personnel will be working towards a stated target and time frame.
- No need to cater for training costs of teaching employees on house to make use and maintain the system since all is done internally.
- It is important in retaining Pick n Pay's competitive advantage since it is hard to do so when a firm has been approached to develop the system and knows all the company operations and actions.
- Helps increase organizational innovation, image and company operations.
- Total control of the system is assured.

3.7.3.2 Disadvantages Of In-House Development

- Internal developers may lack standard expertise to develop a standard system.

- In-house development requires a strong budget from both the development phase and maintenance of the system.
- Start-up costs can be hard to manage.

ALTERNATIVE	COST SUMMARY (US$)
Outsourcing	15 000
Improving current system	10 200
In-house development	7 500

Table 10: Alternative Analysis Table

3.7.4 Conclusion Of Analysis

Pick n Pay saw it of a greater advantage to opt for in-house development since the cost is lesser than the other alternatives at the same time, benefits of in-house development have a hope of making them have a greater competitive advantage than its competitors in the future.

3.8 REQUIREMENTS ANALYSIS

Requirements analysis is more like a contract between the developer and the client. It assesses wat the system should fulfill basing on current problems and future plans in relation to customer requirements. System functionality should fulfill organizational operations in every way.

3.8.1 Functional Requirements

Functional requirements look at 4 aspects:-

1. Functions that are expected to be supported by the proposed system.
2. Inputs that will be put into the system.
3. Outputs or feedback from the system.
4. Data to be managed by the system in its operation.

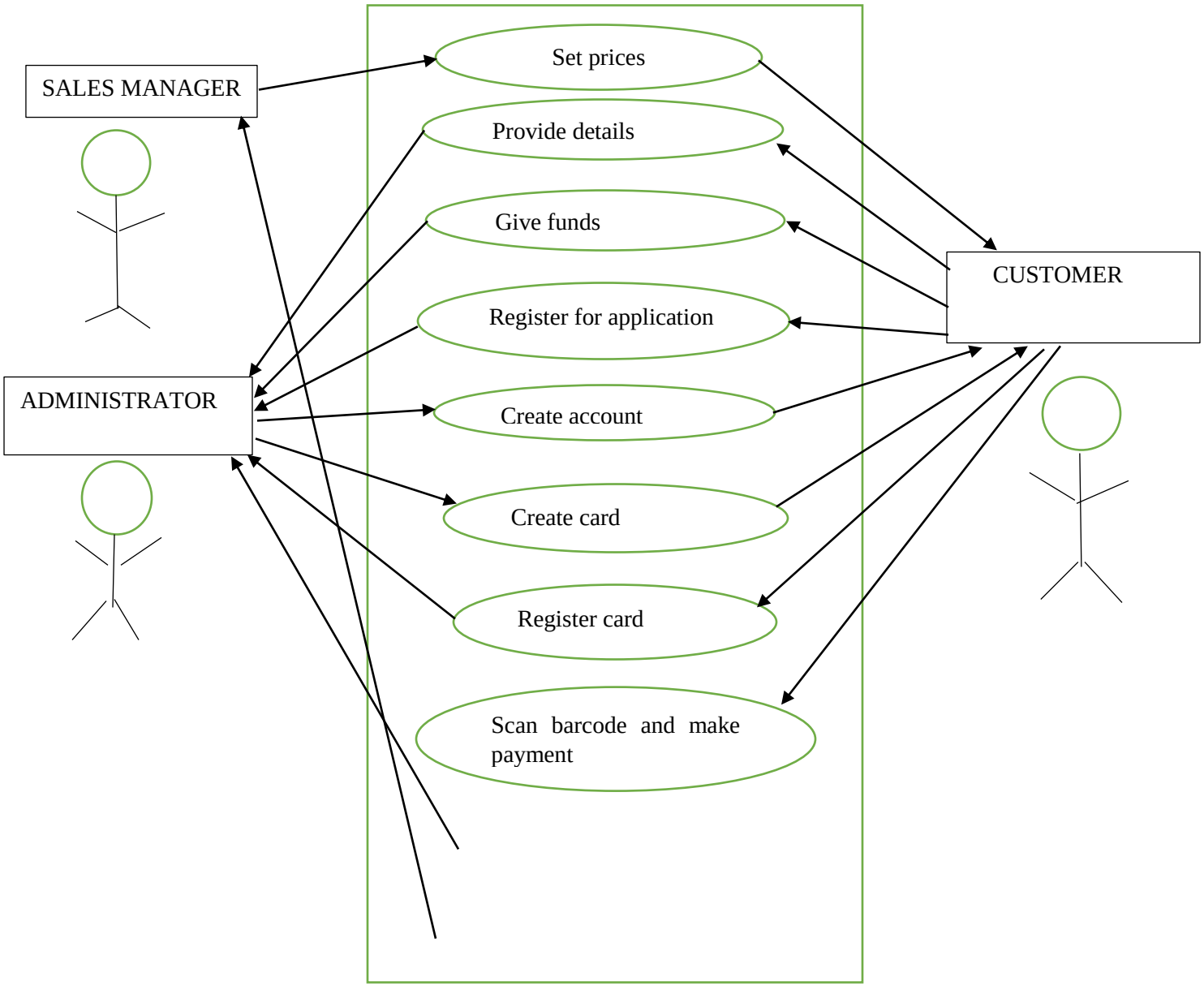
The Pick n Pay customer self-service mobile application will have the following functional requirements:-

- System security is a major concern, unauthorized users should not have access to the database and is operations.

- Report generation should be fast, efficient and accurate.
- Multiple users should be able to access the system concurrently at the same time.
- It should be able to know a specific area of concern each time the database is queried.
- Virtual receipt should be quickly generated as soon as payment has been done.
- Automatic updates should occur each time a customer purchases or deposits money I his account.
- System should have user access levels.

3.8.1.1 The Use Of Case Diagram

According to Kulak (2012) a use case diagram is a representation or methodology that shows the relationships between system entities and their duties. It shows how a user interacts with the system to achieve a certain goal.



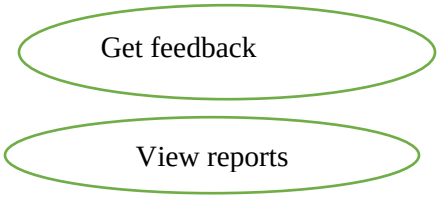


Figure 3.4: Use Case Diagram For The Proposed System

3.8.2 Non-Functional Requirements

Non-functional requirements look at how the proposed system will support the functional requirements in performance, security, reliability and usability (Chung, 2012). Some of these requirements are shown below:-

- System should have a facility for backup in the event of data loss.
- It should be understandable to the user that s, it should be user friendly.
- It should have a facility for error handling, which is it should have error recovery platform.
- System security should be looked at therefore the use of passwords for every user is important.
- It is supposed to have a quick response time.
- It should be reliable, that is doing the correct things at the right time each and every time.
- It should be usable to every individual.
- It must be easy to maintain and shouldn't be vague in its use.

3.8.2.1 Constraints

Time: project completion within the stipulated time might be difficult due to some constraints that might come on the way.

Costs: It might be difficult for Pick n Pay to face the possible costs for a standard system development.

Adequate funds: Project costs and company budget might conflict.

3.9 CONCLUSION

Researcher has described the current system and considered the alternatives, activities and functionality of the system. It has been concluded that there is need to develop the new system

therefore the next chapter will dwell much in designing the proposed system and giving a brief description of its functionality.

CHAPTER FOUR: SYSTEM DESIGN

4.1 INTRODUCTION

This chapter will involve defining and analyzing the system's architecture, modules, components and system data. An analysis was made in the previous chapter and after analyzing the loopholes of the current system then there is need to move on to the design phase. Basing on the system requirements analyzed in the previous chapter, the system will be developed to meet user requirements and at the same time solving problems analyzed. This chapter will look at the systems architecture, database design, interface design, program design, physical design and finally the test design of the proposed system.

4.2 PROPOSED SYSTEMS DESIGN

According to Flynn (2011) system design is that process of defining the architecture, components, interfaces, modules and system data. Major concern is to meet user requirements and organizational goals through a well-functioning system. An impressive functioning system should have the following characteristics:-

- **Effective** – this involves developing a system that is error free and does not affect the organizational working and processing environment. At the same time, system should be a problem solver and meeting all the company objectives in its day to day running of the business.

- **Reliable** – system should be able to provide information and reports in a timely manner whenever needed. It should be a solution to the current system's problems and should not delay decision making of the top management.
- **Efficient** – system should provide correct, required and accurate answers or solutions to a problem at a certain given period of time.
- **Secure** – organizational confidentiality should be a key element. Therefore system should have access levels in system usage to avoid licking of important information that will hinder system performance.
- Maintainable – operation of system should not be vague. It should be effective and efficient and should give room for system upgrades whenever required.

4.2.1 Major Systems Functionalities

This will show the major areas of concern that will lead to the full functionality of the system. These are described below:-

- **Products module** – this is the platform to which product bar codes are added in store and also updates of outdated or obsolete products are recorded. It also allows employee to view the available products in store.
- **Customers' module** – this is where new customers are added and where they deposit their moneys and a virtual card created for them to use for their shopping. Available customers recorded are also visible on this platform.
- **Administrator module** – is for the creating or deleting of users, that is administrators or sales managers that have the permission to access the system.
- **Sales manager (or representative) module** – adds new products and customers into the system and makes customer deposit entries.
- **Sales report module** – report on sales for the day and a given period of time is shown on this platform.
- **Account details** – shows accounts deposited by a specific user and balances for each user soon after purchasing products.

- **Purchases module** – this is the platform where customers scan barcodes of desired groceries and pay for them using their virtual debit cards. It also shows the customer its account balance so that they purchase according to the funds in their account.

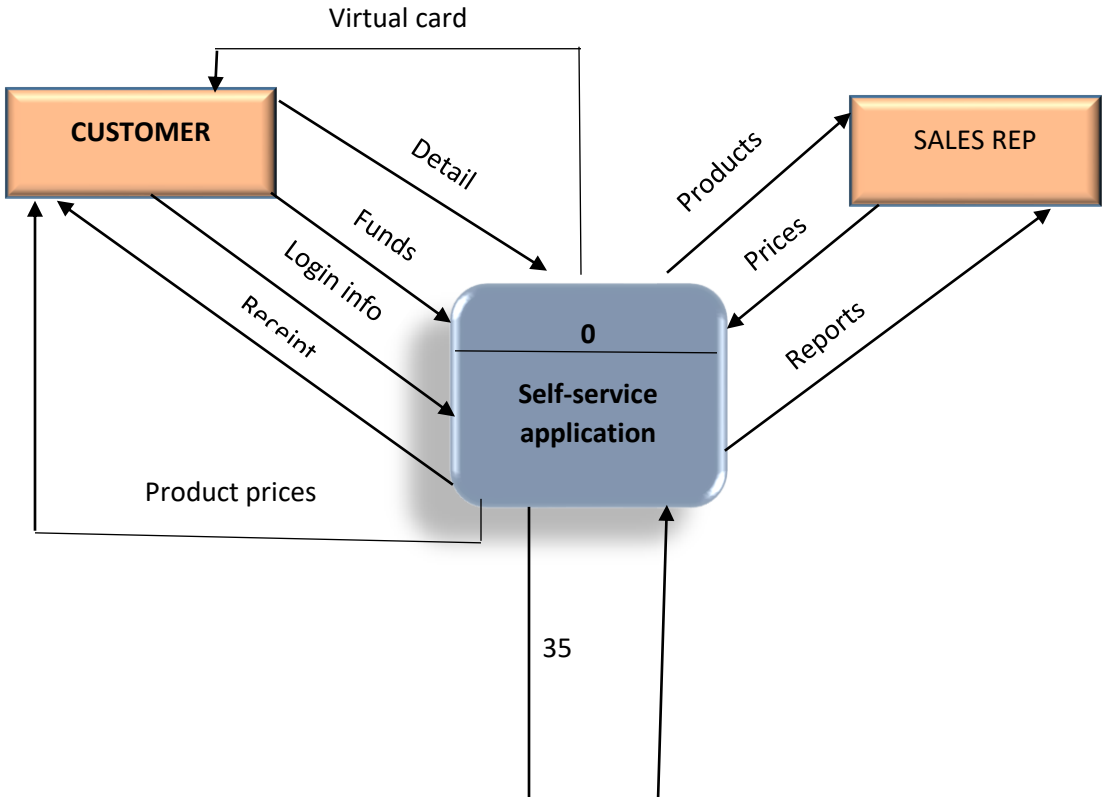
4.2.2 Proposed Systems Description Design Overview

Proposed system overview is as follows:-

Administrator creates user accounts that is for the sales representative or manager. Sales representative sets the commodity price and description in the system. Sales Rep or administrator creates customer accounts and give then a virtual debit card, in which they will deposit their money that they will use as they will be buying and a known card number that they will use to purchase in Pick n Pay stores. Customer first verifies account by signing in using his or her I.D number thereafter system asks him to enter a pin code for logging into the system. Customer logs in using card number and desired pin code. To buy goods, customer scans barcodes of commodities using a smart phone and adds the goods to cart. After this has been done and customer wants to pay for the goods, he clicks on the order and pay button and total amount for the goods will be deducted from the debit card. A sms virtual receipt is then sent to and received by the customer to verify the goods bought, in relation to prices and quantities and this will be used for verification by the guard when checking physical products in relation to virtual receipt. Sales manager can now view report on daily sales, weekly, monthly or yearly sales.

4.2.3 Proposed Systems Context Diagram

Below is the context diagram of the proposed system:-



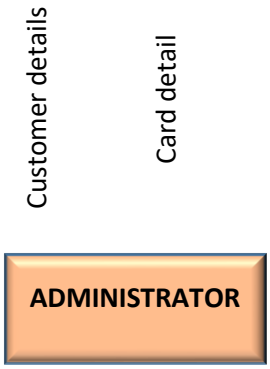
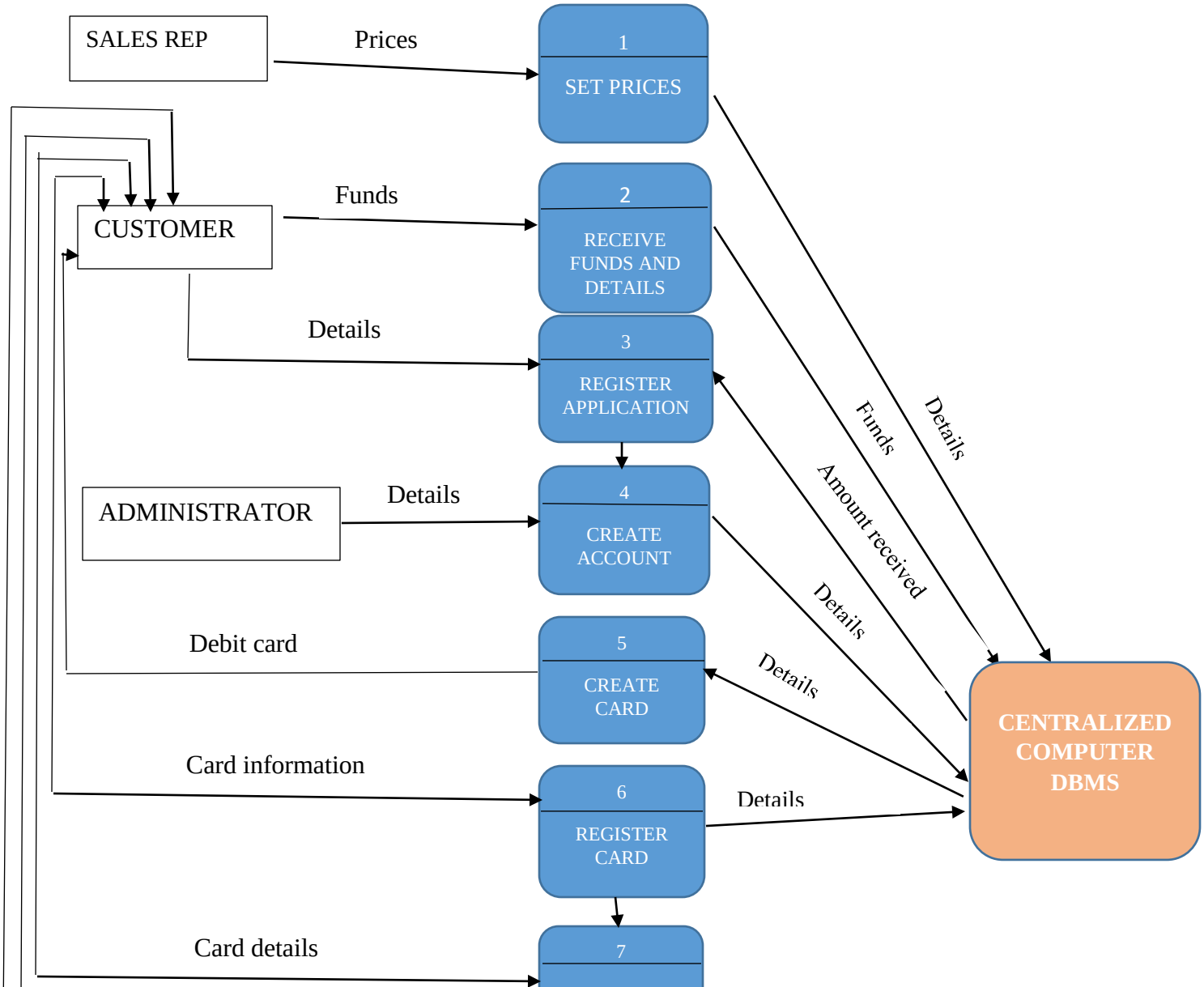


Figure 4.1: Context Diagram

4.2.4 Proposed Systems Dataflow Diagram

Below is the dataflow diagram of the proposed system:-



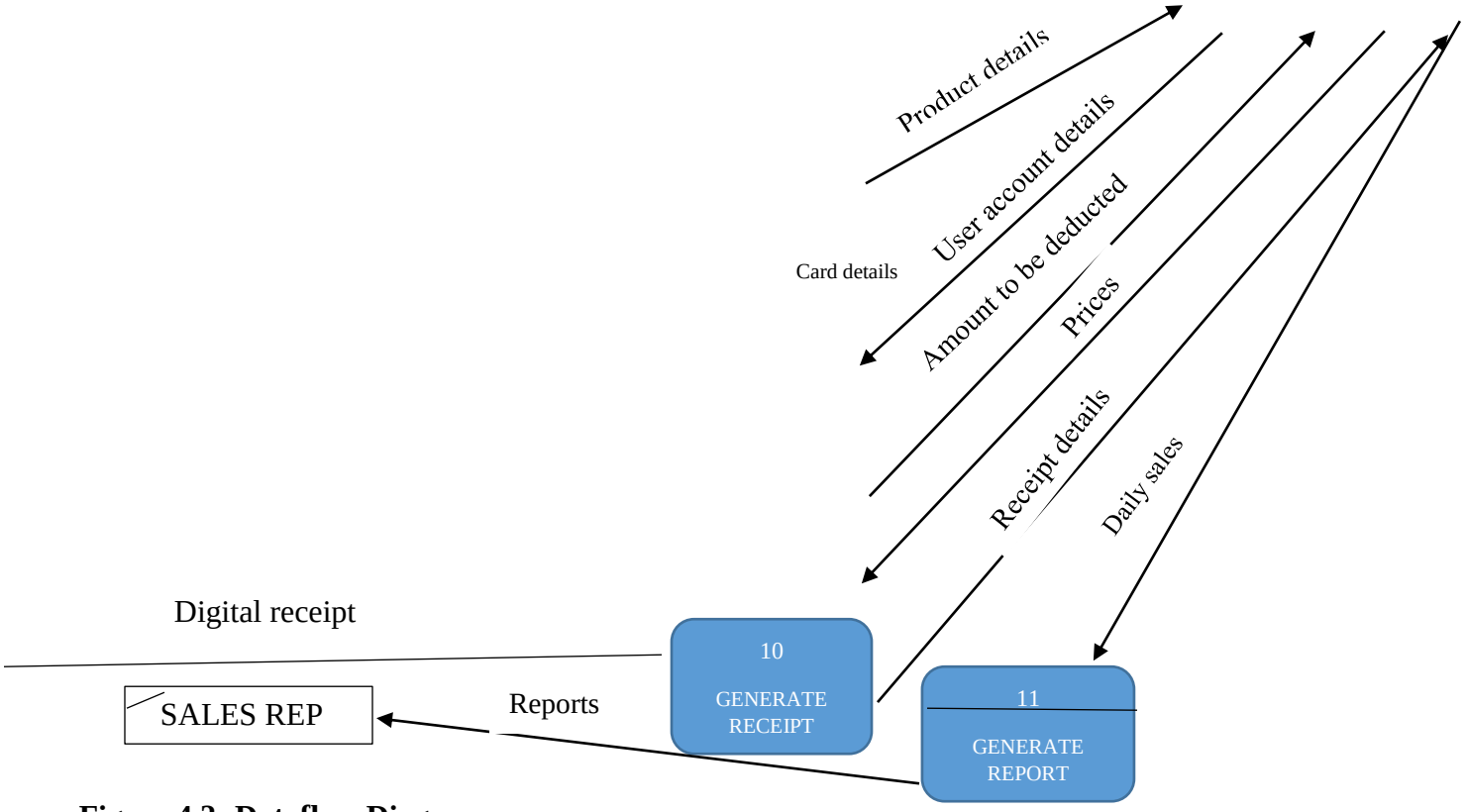
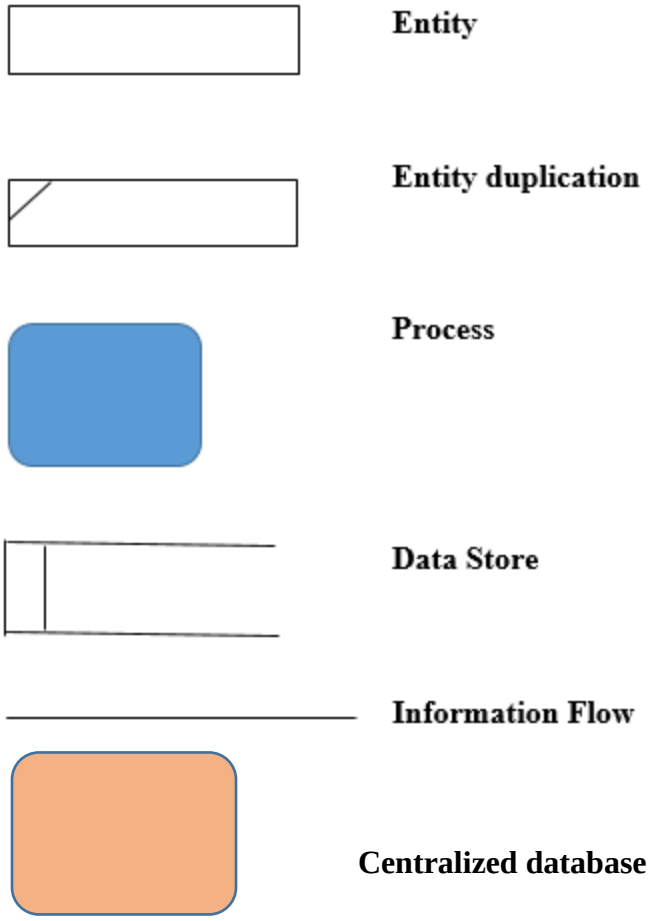


Figure 4.2: Dataflow Diagram



4.3 ARCHITECTURAL DIAGRAM

System architecture describes the behavior structure and relation between system components.it is a diagrammatic representation of the system and how it will interact with its entities, hardware and software infrastructure. Major thrust is on minimizing problems that might hinder system performance. It will also look at the hardware platform to which the system will run and the various software's that will make the system workable. Inputs and outputs on each link and flow of data will be looked at. System will be both windows based and application based.

Below is a general elucidation of the various architectures to be included for system to be efficient:-

Mobile device – device will act as a router through the use of wifi hotspot. Customer will be able to purchase goods using their mobile device.

Windows application (laptop) – is the one that will be used by Pick n Pay representatives to offer services to its customers.

Database (laptop) – will act as a storage platform to which all entries will be recorded and queried for report generation.

IIS Webserver (laptop) – Will help integrate all the applications that will make the system workable and provide with internet information services.

4.3.1 Client Server Approach

It shows a diagrammatic way on how the server and client interacts. It shows the various mediums to which each individual user uses to query the database and how processes are done to complete each action. Below is the system design architecture for the customer self-service mobile application.

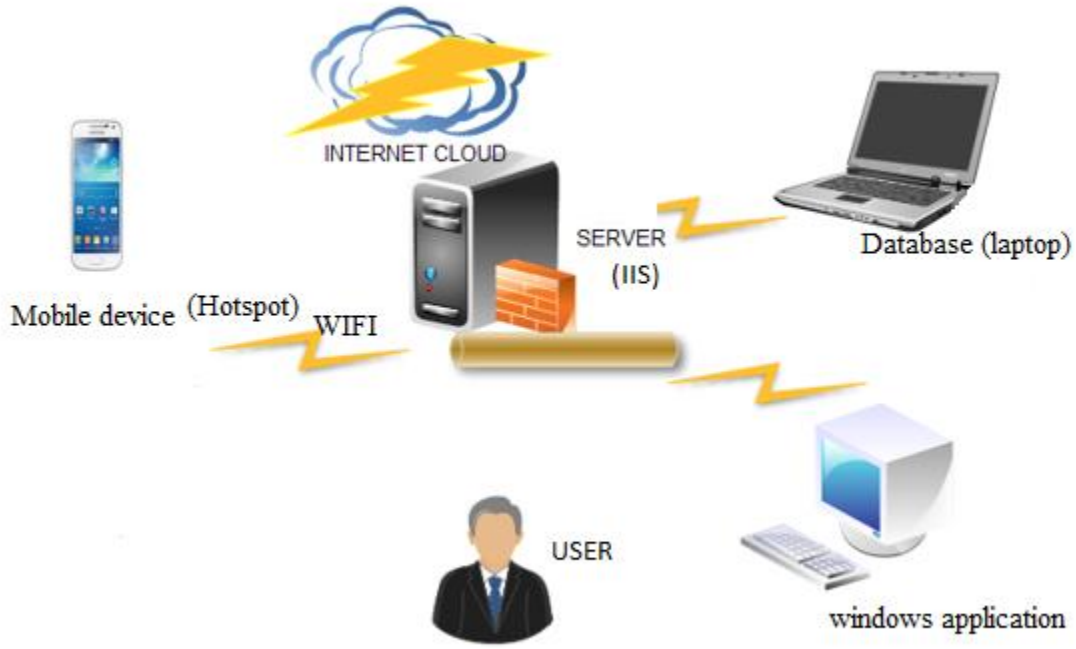


Figure 4.3: System Design Architecture

4.4 PHYSICAL DESIGN

Here, the technical environment to which the proposed system will be implemented is described and the ways in which networks will be linked is defined. System will be controlled and centralized in the administrator's office and the sales representatives will access system services via the LAN. This will increase security levels and improve system monitoring.

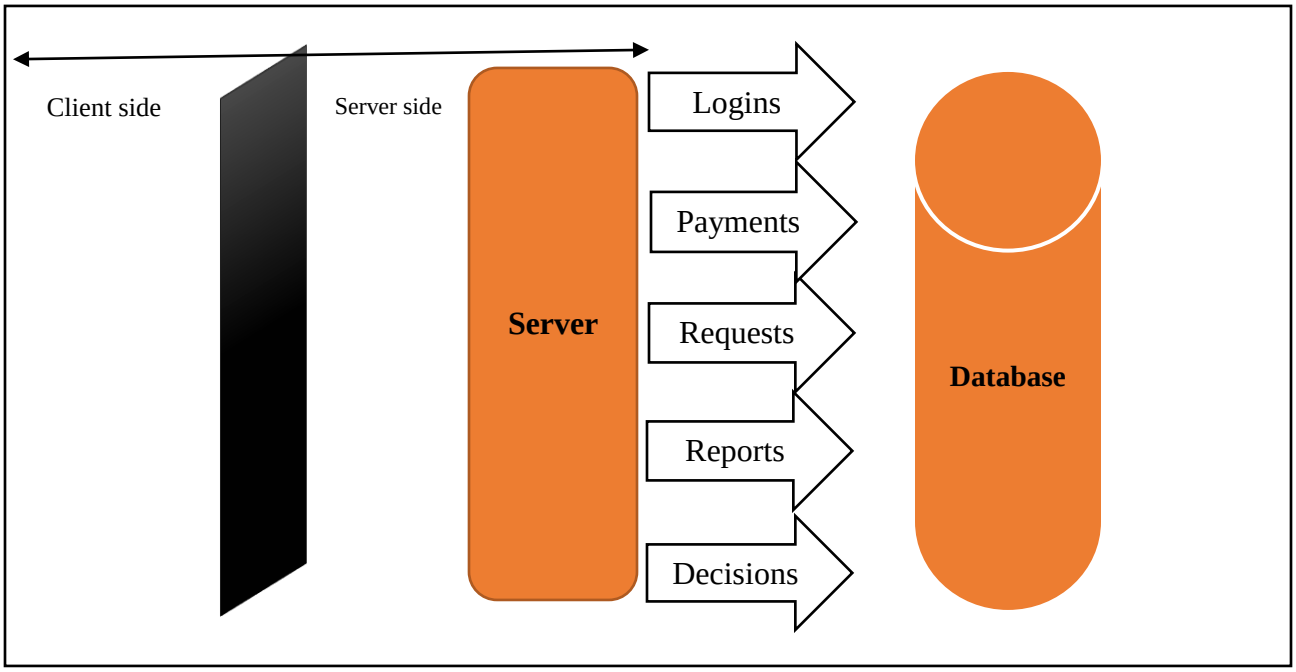


Figure 4.4: System Database Architecture

4.5 DATABASE DESIGN

It is the process of coming up with a database data model. In includes entity relationships, physical design that is, keys, columns and table and CAD tools used for the data. Success of the proposed system will depend on meeting all the user requirements and its capability of solving all the identified problems. Database should promote consistency, integrity and minimization of redundancy.

4.5.1 Database Design Architecture

The architecture's main focus is on designing, developing and maintaining of programs that are responsible for storing and organizing required information for the organization. Software is developed and implemented by the architecture with the main reason of meeting user needs. Architecture will show the various entities that will directly and indirectly link to the database schema. Below is a diagrammatic design of the schema:-

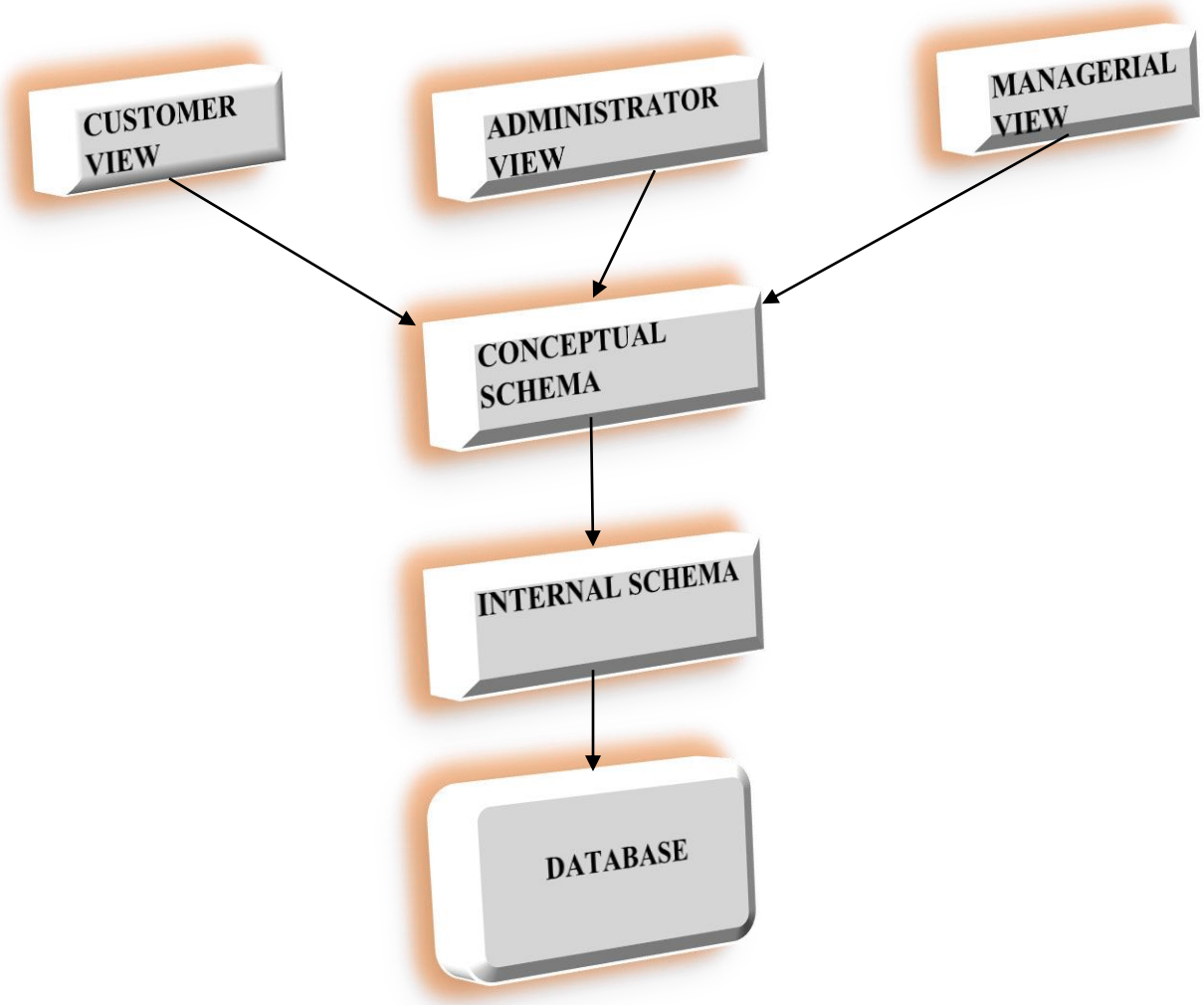


Figure 4.5: Database Schema

External view

This is the external view of the database schema also known as the highest level. It provides an interactive interface for the user that will help them manipulate required data at any given point in time. Some parts of the database and implementation details are hidden from the users and only information relevant to them can be accessed. This is for the sake of enhancing security to the company database.

Conceptual level

This shows how the data in the database is related and how this data is stored in schema. Database design for the community is defined at this level. Main focus in on entity description, relationship between entities, user operation, data types and the rules or constraints that govern the schema.

Physical level

It's mainly responsible for storing data in different forms, which can only be readable by the database management system.

Database

This is the actual database or repository to which all the information will be stored and retrieved from.

4.5.2 Data Modeling

Is the process of creating a data model and having the knowledge of how the data will relate. In involves analyzing and defining the required data that is to be stored in the database. This data must match with the organization's information system. The entity relationship diagram and the enhanced entity relationship diagram will help elucidate the concept of data modelling.

4.5.2.1 Entity Relationship Diagram

It is a modelling technique that diagrammatically shows the relationship between entities. Its elements include attributes relationships and entities. To create an entity relationship diagram one has to:-

- Identify and define entities
- Determine the interaction between entities
- Determine the cardinality of the relationships between these entities
- Finally create the diagram

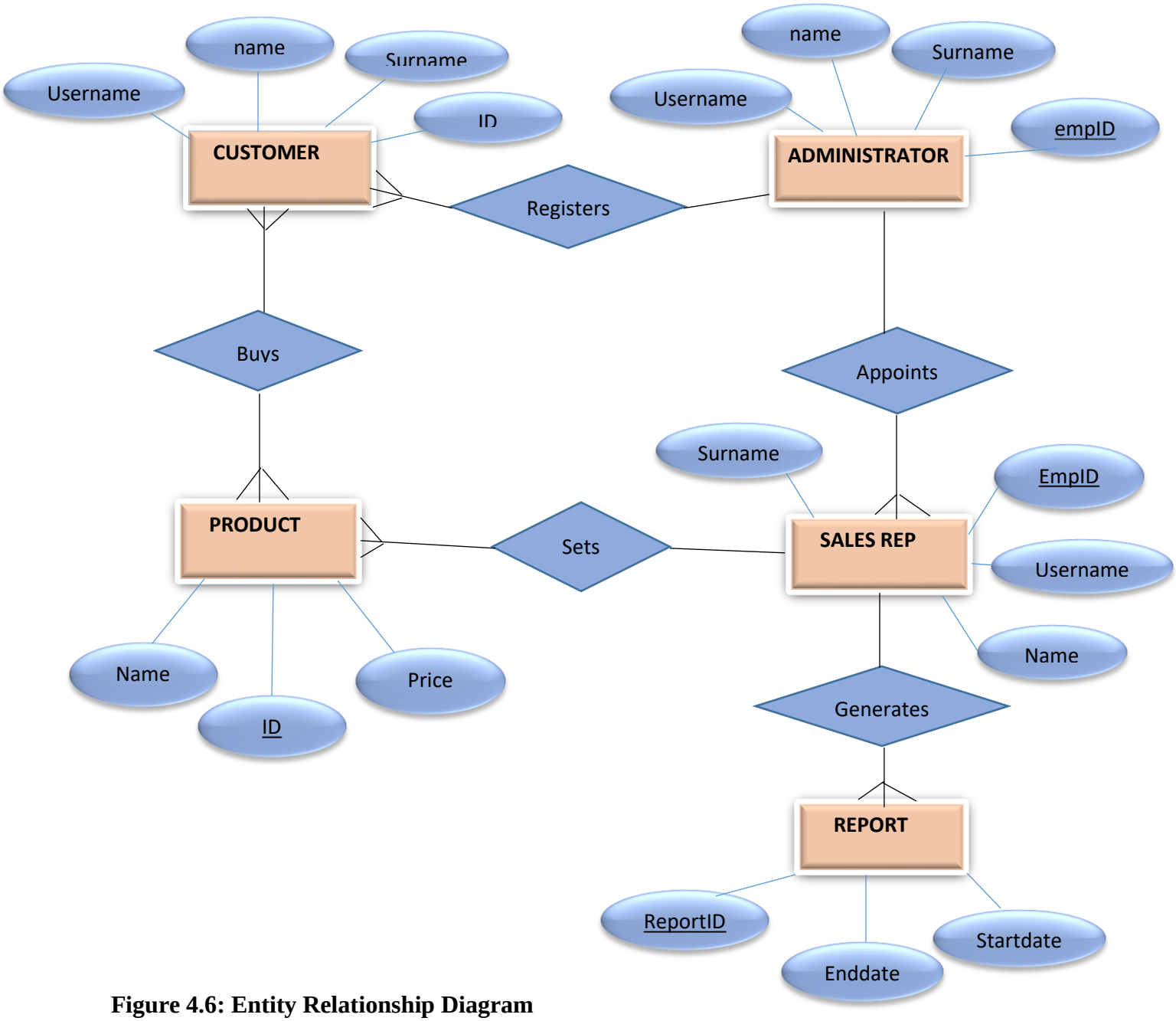


Figure 4.6: Entity Relationship Diagram

KEY

RELATIONSHIP

ENTITY

ATTRIBUTE

DATAFLOW

4.5.2.2 Tables Of The Systems Database

Client registration

TITLE	LENGTH	DATATYPE
Name	30	String
National_ID	11	Varchar
Mobile_no	10	Integer
Card_no	4	Integer
Deposit_amount	6	Integer

Table 11: Client Registration

Adding new Products

TITLE	LENGTH	DATATYPE
Bar_code	13	Integer
Item_name	40	Varchar
Item_cost_unit	6	Double
Description	40	Varchar

Table 12: Adding new Products

Create user account details

TITLE	LENGTH	DATATYPE
Name	30	String
Username	30	String
Password	10	Varchar
Access_Type	10	String

Table 13: User Account Details

4.5.2.3 Enhanced Entity Relationship Diagram

An enhanced entity relationship shows the subtype and super type relationships between entities.

Below is the enhanced ERD for the system database.

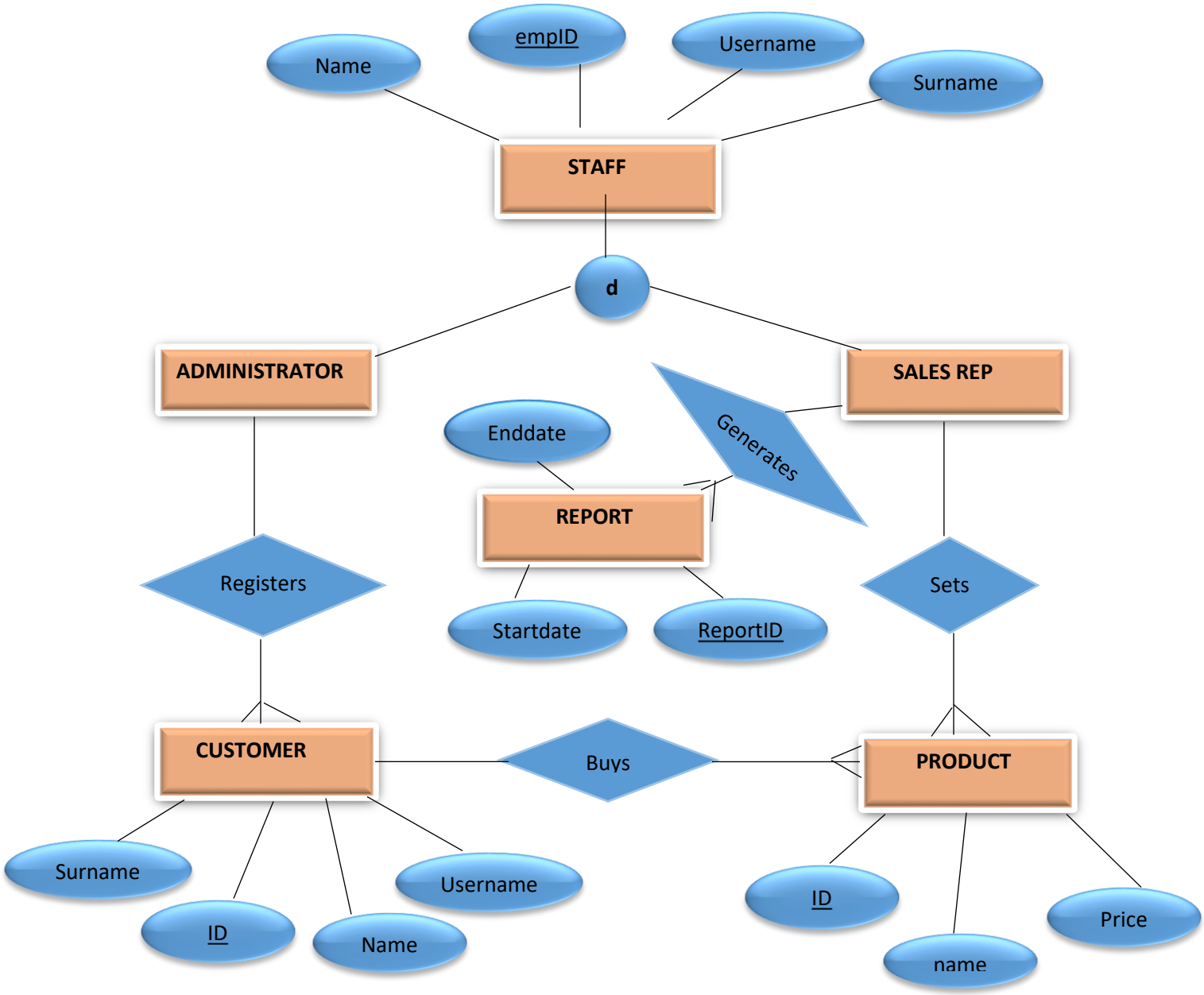
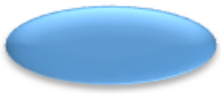


Figure 4.7: Enhanced Entity Relationship Diagram

KEY

RELATIONSHIP

ENTITY



ATTRIBUTE

DATAFLOW

4.6 PROGRAM DESIGN

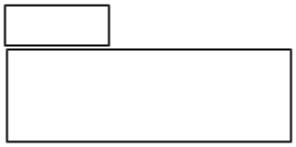
Program design is a modular that assists various entities directly involved to the to make sure that it is performing according to the specified requirements when implemented.

4.6.1 Package Diagram

A package diagram shows how the various packages that make up a model relate to each other. It breaks down complex projects into simplified modules through the use of diagrammatic representation.

KEY FOR DIAGRAM BELOW

Dependencies



System module

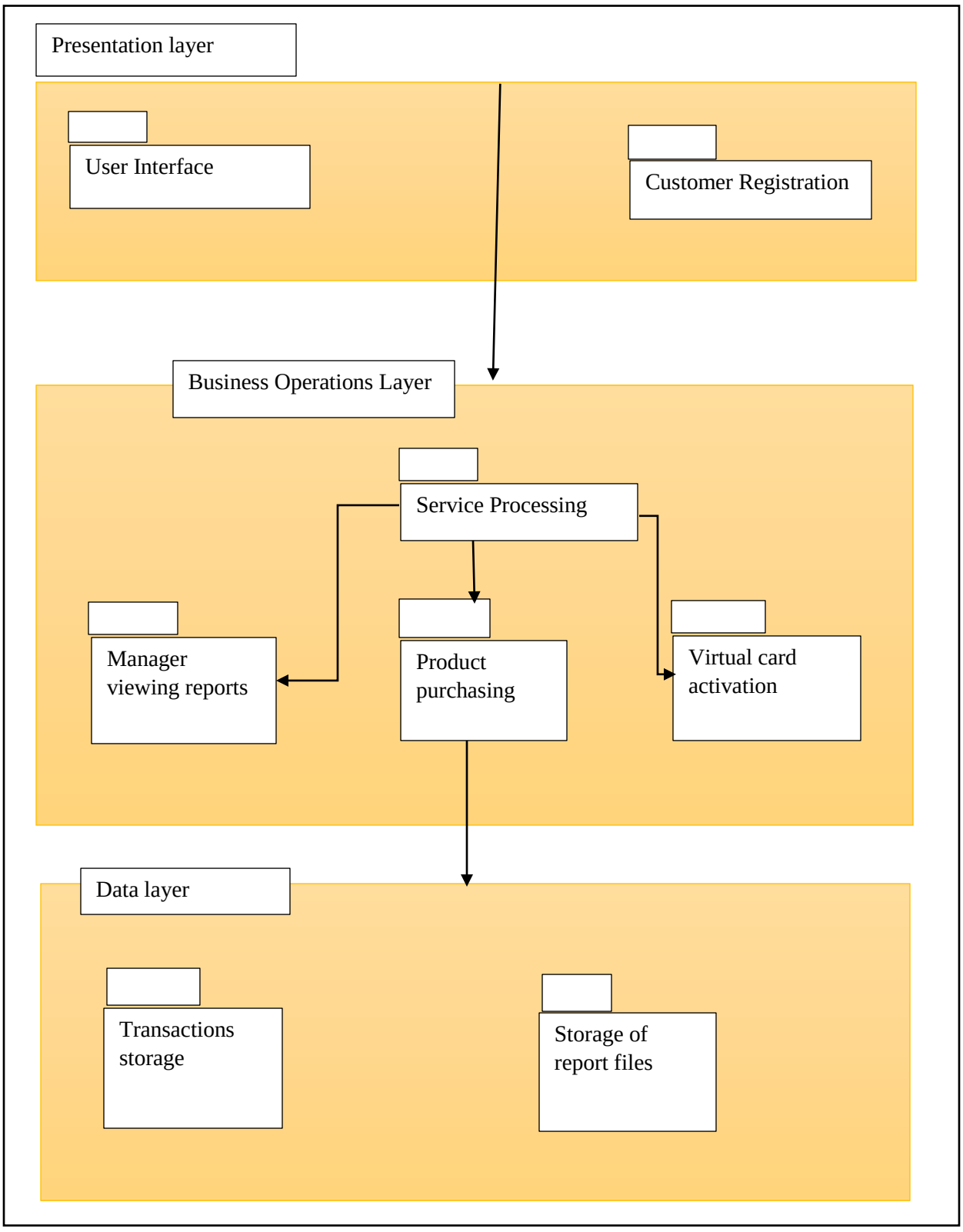


Figure 4.8: Package Diagram

4.6.2 Class Diagram

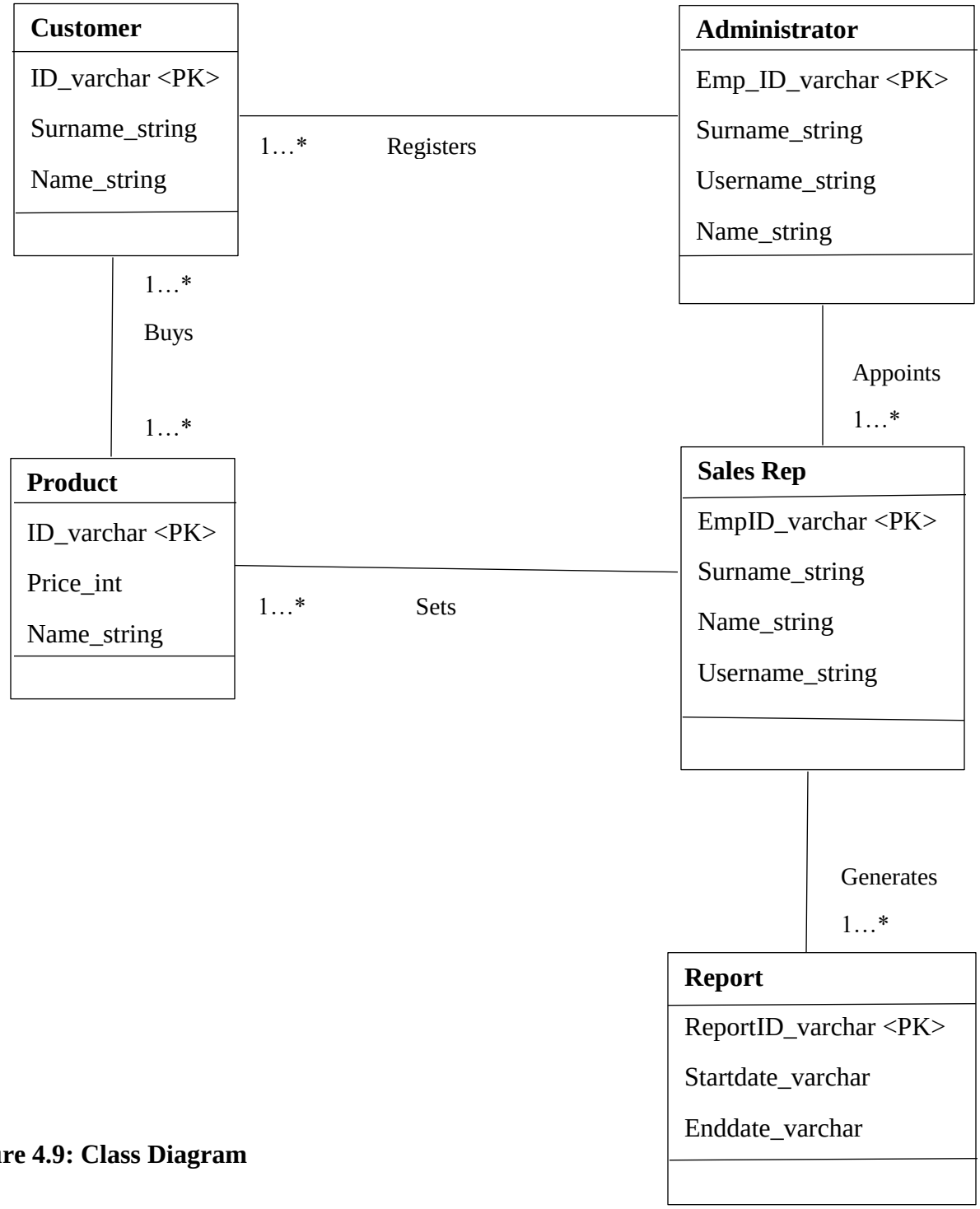


Figure 4.9: Class Diagram

4.6.3 Sequence Diagram

According to Daniels (2003) sequence diagrams are interactive diagrams that deal with objects that work hand in hand. They focus on how given tasks interact over time to meet a given target. Below is a sequence diagram for Pick n Pay stores.

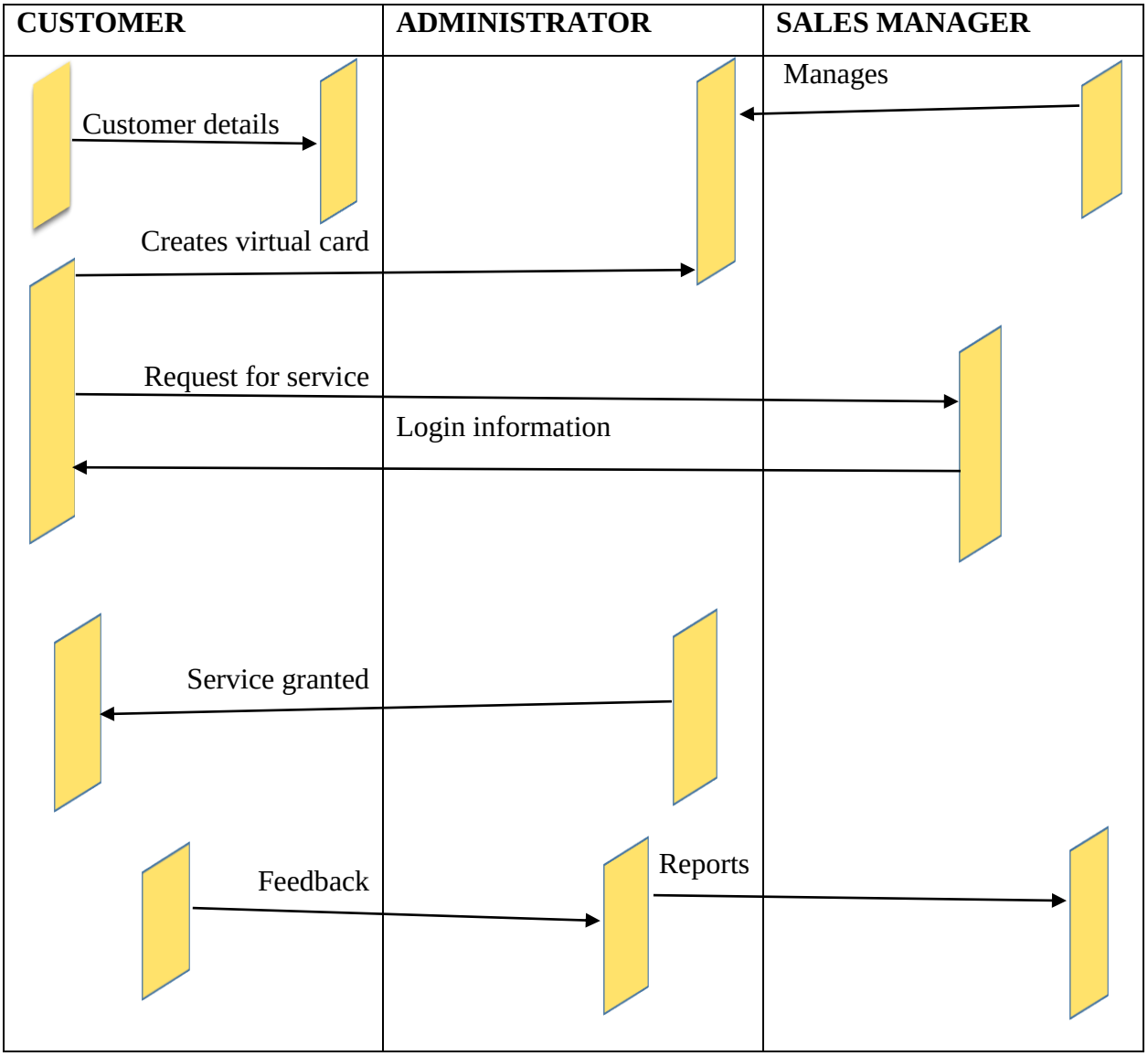


Figure 4.10: Sequence Diagram

4.7 INTERFACE DESIGN

This is what provides the users a platform to interact with the system. Interface of a system should be easier to understand, that is it should not be vague. Users should be able to access any information required through the use of the interface designed. A well-structured interface should be able to provide users with a required service without having to think on what procedures to apply. Everything should be visible on the interface. Galitz (2007) states that the main objective of interface design is to simplify user interaction with the system and to make sure all goals are made efficient.

4.7.1 Fundamental Structure Design

According to Mall (2009) structure design is done so as to facilitate the major functionalities in terms of system design. It defines how internal and external users will navigate information from the system through the use of user interface. Various authentication methods are implemented so as to allow input from users and output from system relevant to each specified user.

The researcher decided to use almost similar interfaces for the windows application so that the internal user won't be confused much and it won't take much time for them to master how the new system operates. The system will have understandable menus for easy navigation and quick performance of duties.

4.7.2 Security Design

The proposed system must be well secured through the use of access rights and authentication. Each user should be able to see information relevant to them only and should not have access to the other parts of the database. The administrator is responsible for creating user account and allocating duties according to their rights on system usage. Through the use of antivirus software, firewalls and other security measures, access to unauthorized users is limited or greatly avoided. Username and passwords are created to ensure security and confidentiality of information.

4.7.2.1 Personnel Login Form

On this platform user is asked to enter his or her user name and password which is already stored in the system, and upon matching user input credentials and database details user is then granted the permission to enter the system, but if they do not match access is denied.

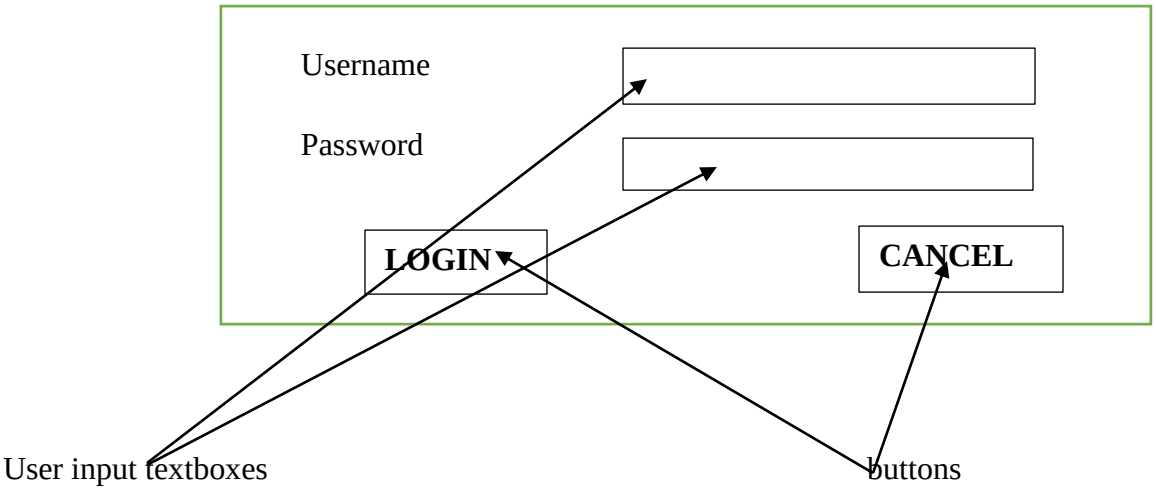


Figure 4.11: Personnel Login Form

4.7.2.2 Customer Login Form

Here, the customer is to enter his or her virtual debit card number and personal pin code to access the system then sign in. if not registered, they have to click the Not registered button and sign up.

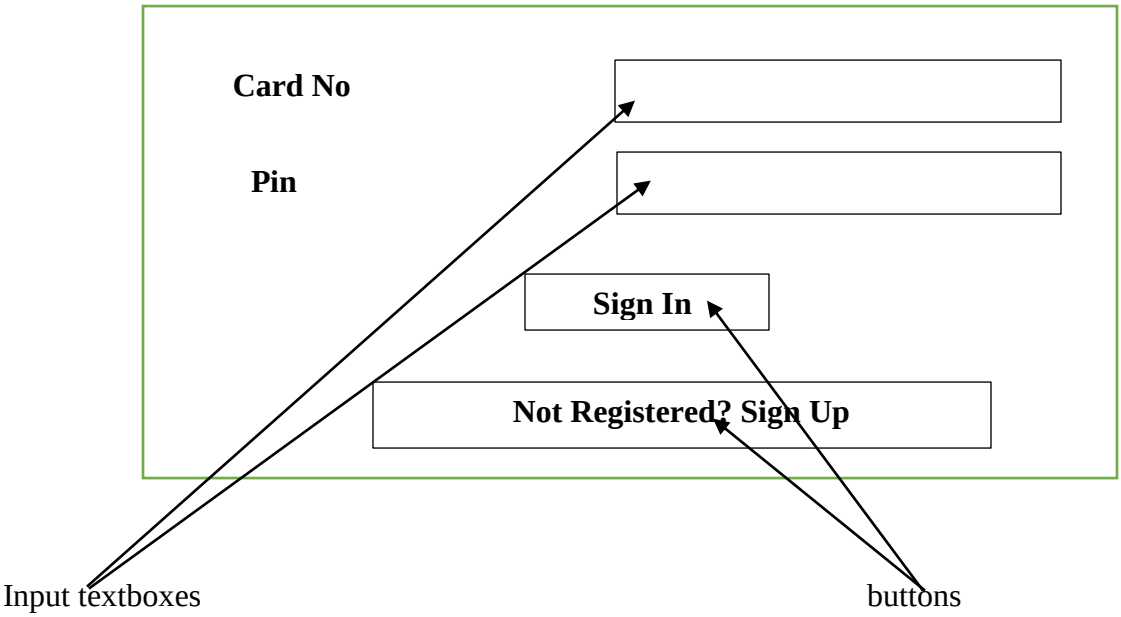


Figure 4.12: Customer Login Form

4.7.2.3 Creating User Account Form

On this platform the windows application user account is created as either administrator or a sales representative.

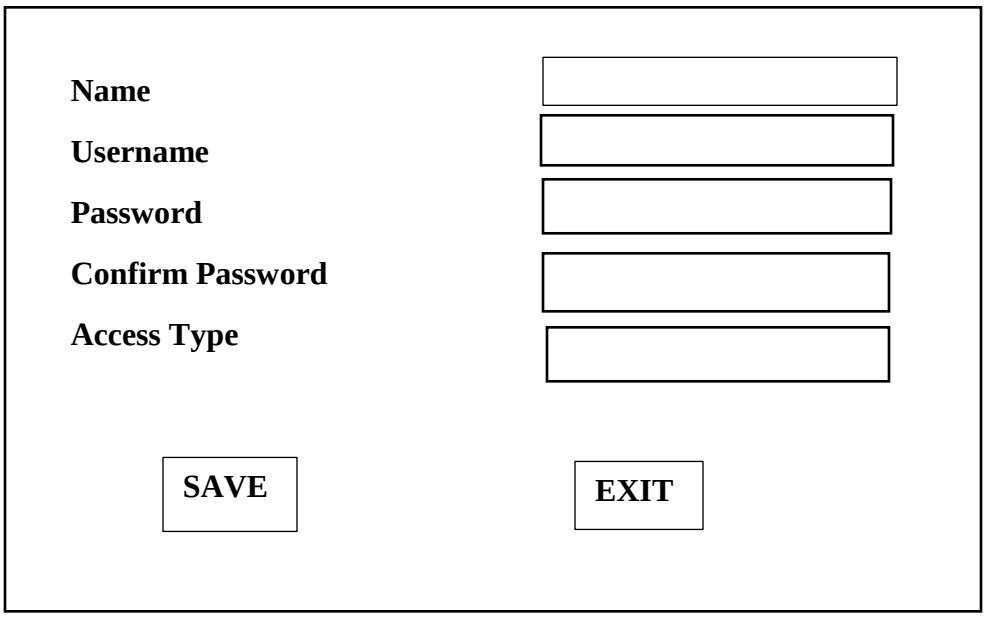


Figure 4.13: Creating User account Form

4.7.3 Main Menu Form

Operations will occur in a procedural way such that, when a user queries the database or inputs information, this input will be processed to give output and the output will navigate to the next form until the service required by the user has been met.

4.7.3.1 Input Design

This forms will accept user input, process and gives out output each time the user queries. Major entities that will make use of the system are the customer, administrator and the sales representative. Input forms will be validated so as to provide relevant information from each user and this will then be processed to assist the users. Text boxes were used to allow text input from users. Below are various input forms that will be used in the design of the proposed system.

4.7.3.1.1 Customer Registration Form

This form will be used to register customers for the mobile application to function in the Pick n Pay stores.

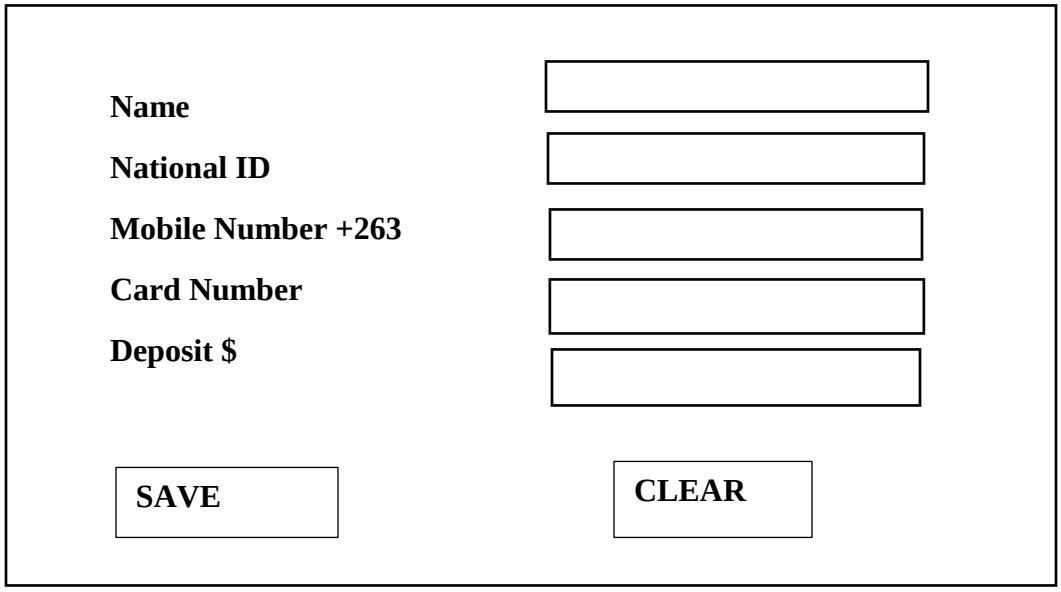


Figure 4.14: Customer Registration Form

4.7.3.1.2 Adding New Products Form

This form is mainly for adding new products in stock showing their description and prices. This information will then appear each time a customer scans barcode of a certain product.

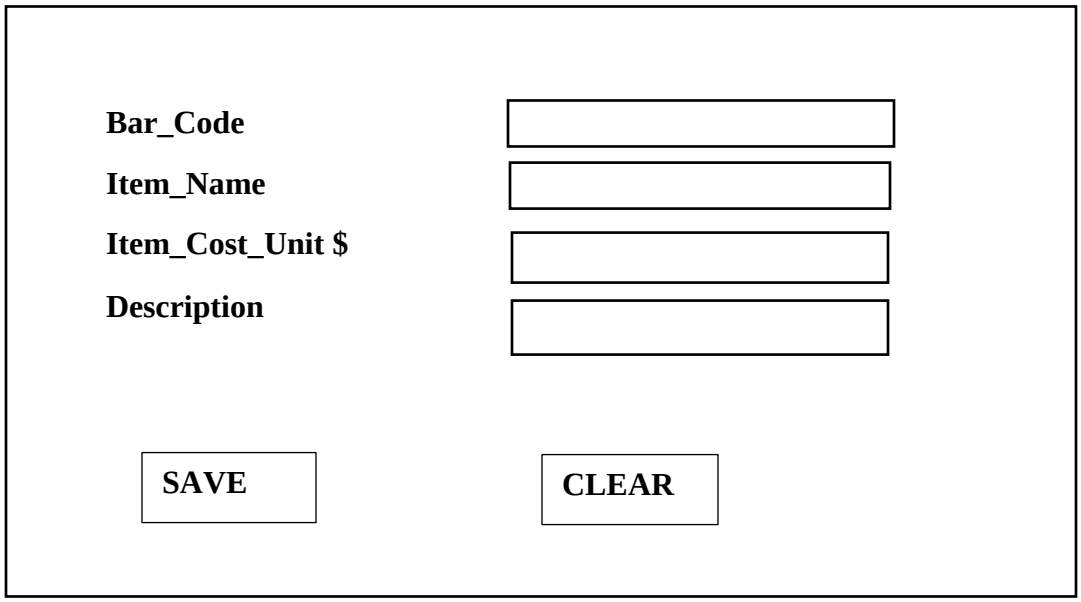


Figure 4.15: Adding New Product

4.7.3.2 Output Design

These will show how the processed information will appear after being viewed by various entities normally in a summarized way. This information is used for decision making or information planning. Below are output forms that will comprise the proposed system.

4.7.3.2.1 Products Report

This report will show a list of all the products in stock.

		REPORT		
Product_ID	**Barcode**	**Item_Name**	**Cost**	**Item_Description**

Figure 4.16: Products Report

4.7.3.2.2 Customer List

This report will show a list of all customers that have registered for the mobile application system.

		REPORT		
ID	**Cust_Name**	**Cust_ID**	**Card_No**	**Cust_Mobile**

Figure 4.17: Customer List Report

4.7.3.2.3 Account Balance

This report will show the list of balances of accounts for all customers.

		REPORT	
Cust_Name	**Cust_ID**	**Card_No**	**Balance**

Figure 4.18: Account Balance Report

4.7.3.2.4 Sales Journal

The sales journal report will reveal all the product purchased by customers, the transaction i.d, barcode of product, cost, customer card number and date of transaction are shown.

		REPORT		
Transaction_ID	**Barcode**	**Cost**	**Card_No**	**Date_Time**

Figure 4.19: Sales Report

4.7.3.2.5 Order List

The order list report is visible to the customer were by a description of all products scanned and added to cart are summarized and listed and eventually customer decides whether to pay them or delete products from cart.

Figure 4.20: Customer Order List

4.7.3.2.6 CUSTOMER ACCOUNT BALANCE

Customer account balance will show the customer the balance in card before and after purchase of products. This balance will make the customer decide whether to deposit more money in the card or not.

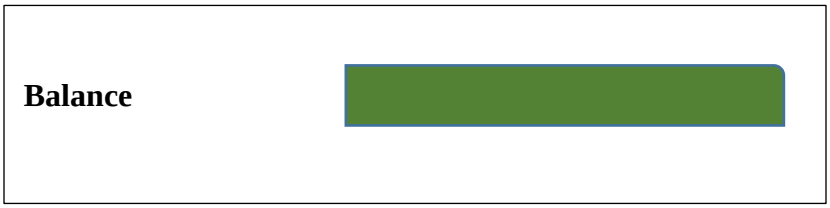


Figure 4.21: Customer Account Balance

4.8 CONCLUSION

This chapter was giving an emphasis on major system's functionality as far as design and integration is concerned. It also gave a view on how data will flow from each and every stage of the system. Design diagrams where shown and now we go on to look at the implementation of the system.

CHAPTER FIVE: IMPLEMENTATION PHASE

5.1 INTRODUCTION

The chapter shows the processes carried out in implementing the proposed system. It makes sure that the system is delivered to the user as per requirements. Ibach (2001) defines system implementation as constructing the new system and delivering the system into production. System modules are analyzed and tests are carried out to check for efficiency and effectiveness. Error handling is also done and loopholes are eventually fixed.

5.2 CODING

Kerig (2004) says coding is the process of defining statements and scripts encoded to come up with a workable and running program. This code which is a form of machine language, understood by the computer is then converted to human language to provide the required by the system users. Functionalities and system operations are determined by the code implemented.

5.3 TESTING

Beizer (2007) defines system testing as performing sequential tests to see the functionality and identify problems of the system. These tests makes it easier to see the possible errors that might hinder the system and they find ways to curb these problems so that it won't affect them in the future running of the system. A number of stages are involved in system testing.

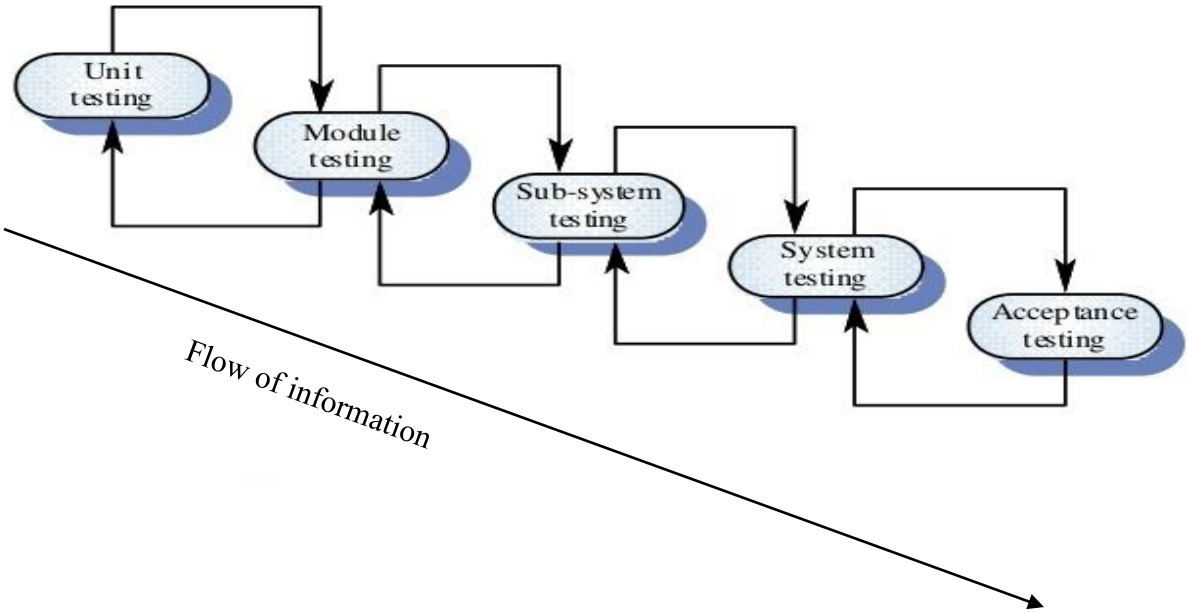


Figure 5.1: Testing Stages

5.3.1 Unit Testing

According to Saleh (2009) unit testing is a process were by the testable units of an application are scrutinized independently to check if they operate properly. Its main aim is to verify the functionality of a selected code area or system component. Two types of testing strategies were used by the researcher that is black box testing and white box testing

5.3.1.1 Black box Testing

Gross (2006) defines black box testing as a testing software method that looks more into the functionality of the system and leaves out the internal structure or operations of the application. This method of testing is applicable any level of the software that is, acceptance, system, integration and unit testing. Main focus is on reaching a specified goal not on the input and how the system generated the results.

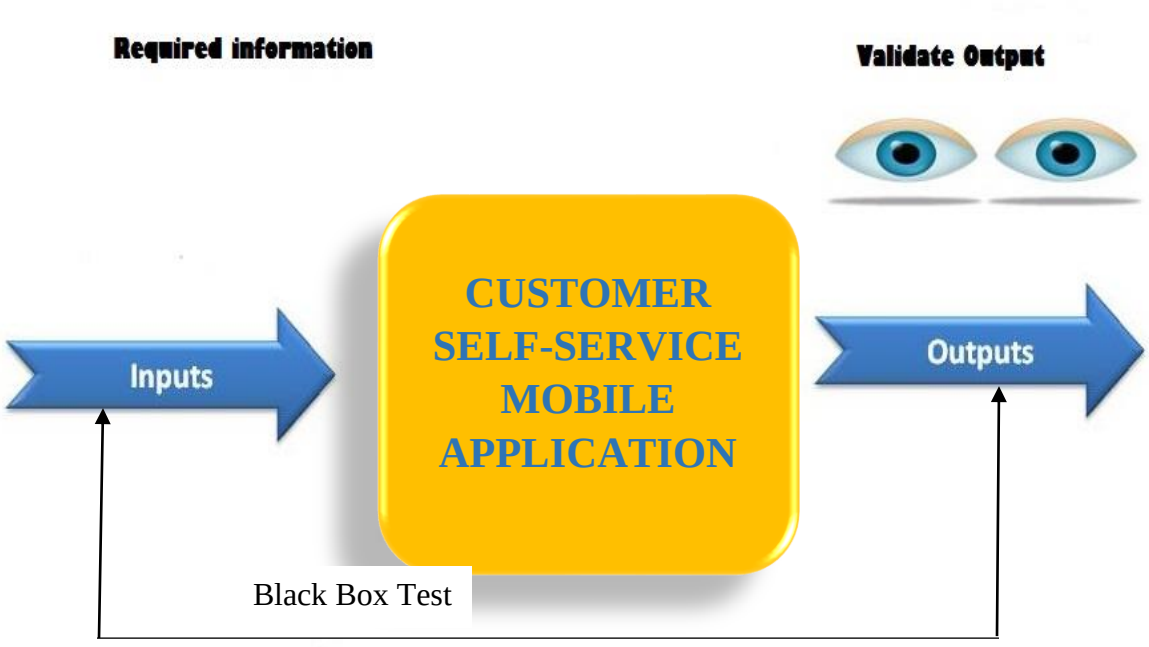


Figure5.2: Black Box Testing

5.3.1.1.1 Advantages Of Black Box Testing

- Due to the presence of complete functional requirement, design is not difficult.
- Tester does not need to have detail on the internal knowledge about the system to be tested.
- It is simple to use since focus is on invalid and valid inputs and to make sure that there is output generation.
- No need for technical expertise when doing black box testing.

5.3.1.1.2 Disadvantages Of Black Box Testing

- No guarantee that every line of code has been tested.
- Result over estimation normally occurs.
- Slow progress since it is difficult to identify all the listed inputs due to limited testing time.

5.3.1.2 White Box Testing

Desikan (2006) states that white box testing tests the internal structure of the application. Main focus is on innermost details of the application. It is also known as glass box testing, clear box

testing, structural testing or transparent box testing. Tester needs much expertise to interact with all the components that were used to develop the application and then give results of the test.

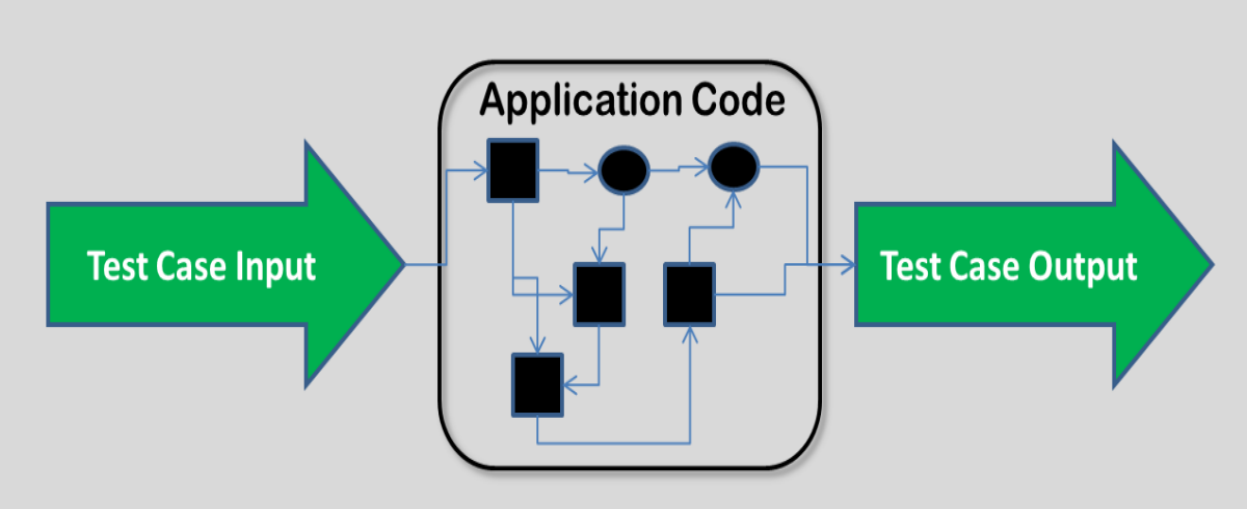


Figure 5.3: White Box Testing

5.3.1.2.1 Advantages Of White Box Testing

- White box testing helps in code optimization.
- It helps remove unnecessary lines of code that can bring defects in program functionality.
- Detection of errors is done earlier before full implementation of the application.

5.3.1.2.2 Disadvantages Of White Box Testing

- It is an expensive method of testing since there is need for a skilled tester.
- Not every line of code will be analyzed hence can lead to failure of the application
- Does not take into account errors of omission.

5.3.2 Module Testing

Saleh (2013) postulates that module testing involves the test and analysis of a list of integrated tests that are extended from the previously discussed unit test. After the developer has written code, the tester comes up with a list of areas that will be checked on defects and interface interaction.

5.3.3 Subsystem Testing

Subsystem testing focuses on testing the application programming interfaces between Subsystems. The test involves testing modules that are unified in a specified subsystem. Pick n Pay customer self-service application was tested as an independent sub system with the central host not linked to the database.

5.3.4 System Testing

All modules are integrated so as to come with the entire system and is then tested so as to see if it performs tasks as it should be and if it solves the loopholes discovered in the problem definition. System should operate according to the defined project scope development. Pick n Pay configured the system on its central network with the main objective of analyzing if it is meeting the required functionalities as desired. System was able to perform all that was lacking in the current system's operation.

5.3.5 Acceptance Testing

After defects have been corrected on the system, system is eventually taken to the users for acceptance testing. Acceptance testing is done by users, stakeholders and customers to see if the system meets their requirements. The major aim of acceptance testing is to gain confidence on system performance. System is also tested to see if it meets business process and to also check its efficiency and quality. Acceptance testing includes Alpha testing and Beta testing.

5.3.5.1 Alpha Testing

The test is done at the site of the developer. Problems stated by the users are noted. Craig (2006) states that alpha testing is normally done when the development is about to complete and it is done by a group independent of the development team for example quality assurance engineers. Changes can be done as a result of this test. This test is done before full implementation to the general public. Alpha testing at Pick n Pay was done in two phases, the first phase involves in-house developers testing for bugs using debugger software and the second phase involves giving the software quality assurance staff for testing in an almost similar environment to the one that the system is supposed to be rum. The test was done at Pick n Pay and changes where done to some interfaces font and color of pages.

5.3.5.2 Beta Testing

According to Pardo (1992) Beta testing is also known as field testing and is implemented on customer site. System is sent to users and they install it to use under real world scenario. It is the phase done secondly (pre-release testing) after alpha testing so as to try out the product. Objective of beta testing is to give the application to actual customers so as to gather issues of system performance from user perspective.

5.3.6 Testing Strategies

These are strategies used by the researcher so as to measure the efficiency and effectiveness of the system proposed. In practicing these strategies errors were identified and eventually corrected. Below are the strategies that were used to test the proposed system performance:

5.3.6.1 Validation

Validation are the actions that check the compliance of the system performance. The system is evaluated to see if it was developed right. For example if we enter string characters in a field that requires numeric characters the system should pop up an error message, and if required input is entered, access should be granted as well.

5.3.6.1.1 Log In Validation

On this platform users are prompted to enter credentials for logging in and if correct details are entered, a user is given access to their authorized window were information specific to them is acquired. Users who are unauthorized won't have access since system will show an error message requiring authenticity to the user. The figure below shows the system login page for the customers and for the windows application internal users:-

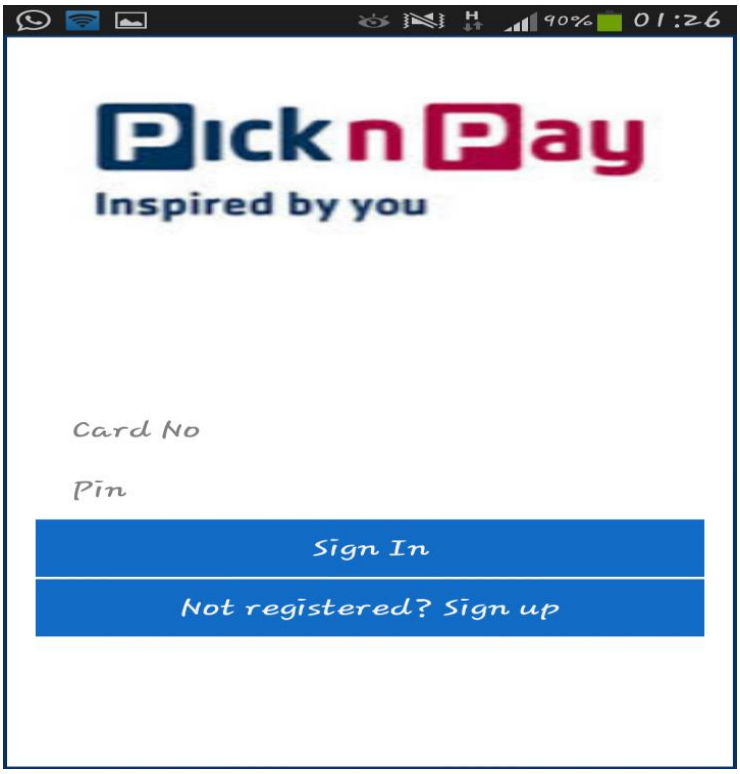


Figure 5.4: Customer Login

Below shows the internal users login window:-

Figure 5.5: Internal Users Login

Below shows the pop out window when incorrect credentials are entered.

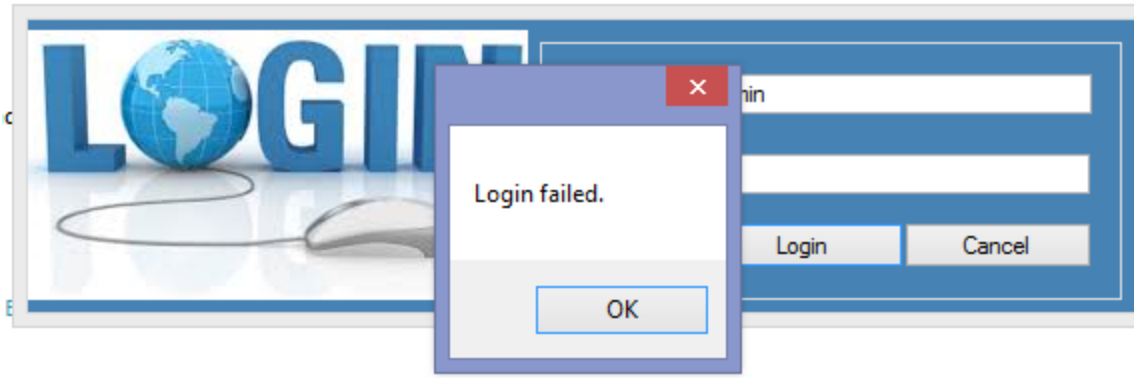


Figure 5.6: User Login Fails

5.3.6.2 User Input Validation

This refers to how correct user information is the moment he or she enters credentials. Credentials should be entered in the text boxes provided.

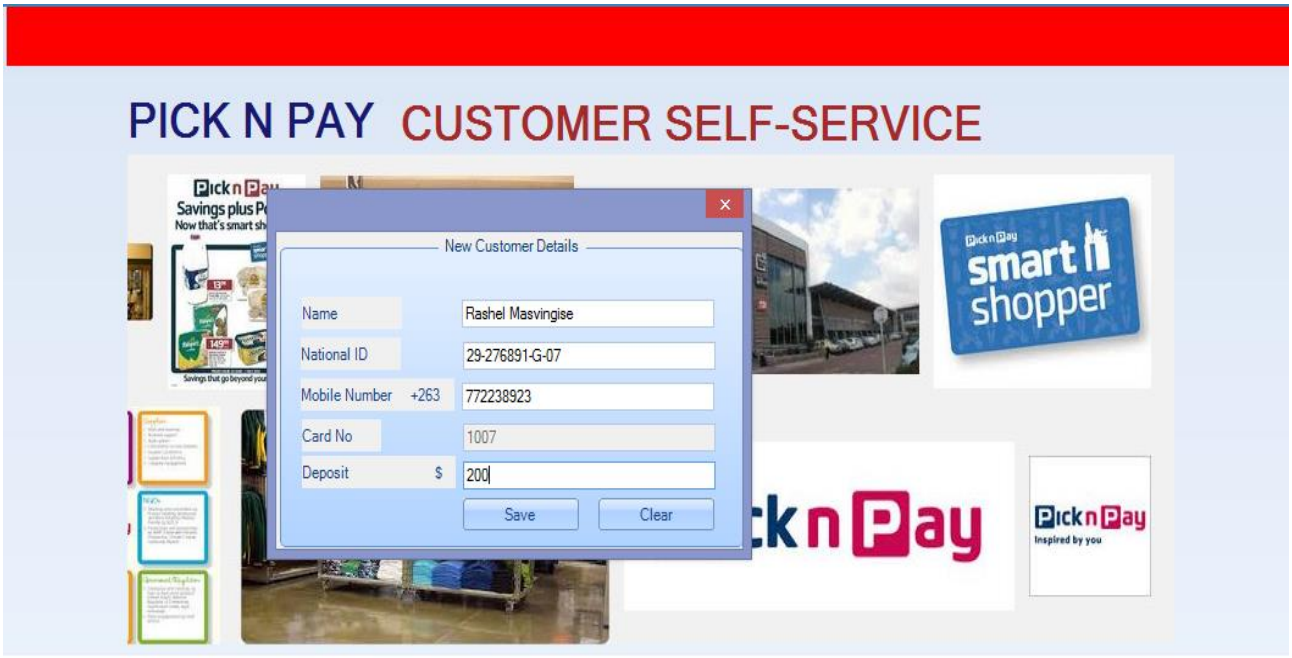


Figure 5.7: Customer Registration

This shows the adding of a new user to the system and the required details and formats in each field.

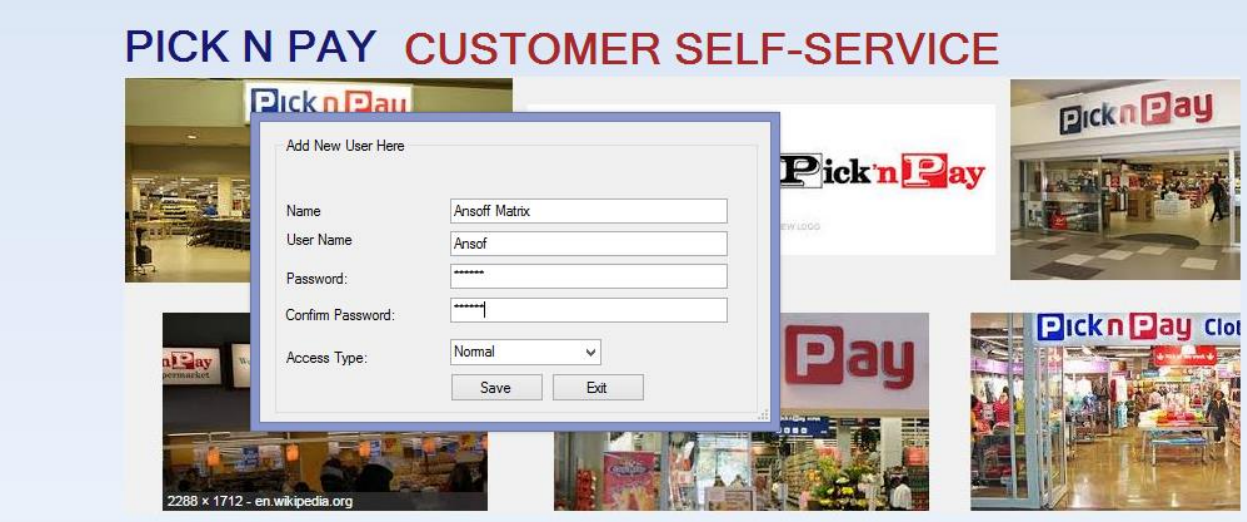


Figure 5.8: Sales Rep Registration

Figure below shows the pop up message when login has been successful.

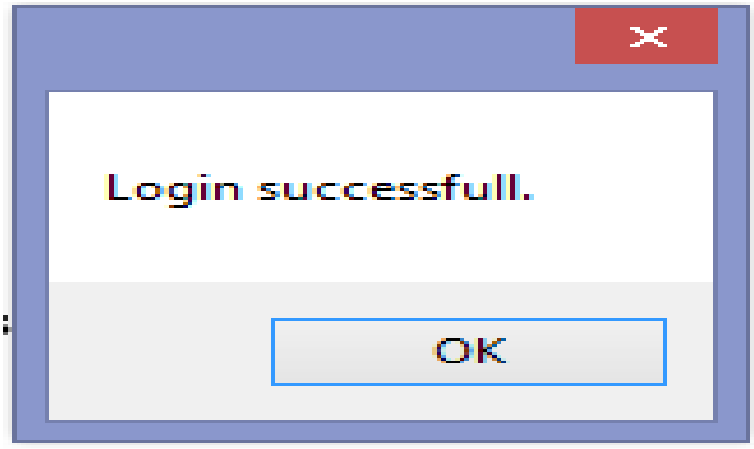


Figure 5.9: Success Login Pop Up Message

5.3.6.3 Test Cases

Pusuluri (2006) states that test cases involve testing for the workability of the system be it system validation and system features. This is done by the system developer before fully implementing the system to the organization. The practice is done by the system developer and the features are determining factor on whether the system is working perfectly or not and is it meeting the stated requirements.

Test Case One: User Login

User or customer must know his or her credentials that is username and password. If credentials are correct users should be granted access, if they are incorrect access to the system resources should be denied.

Screen Shot Admin Login Page

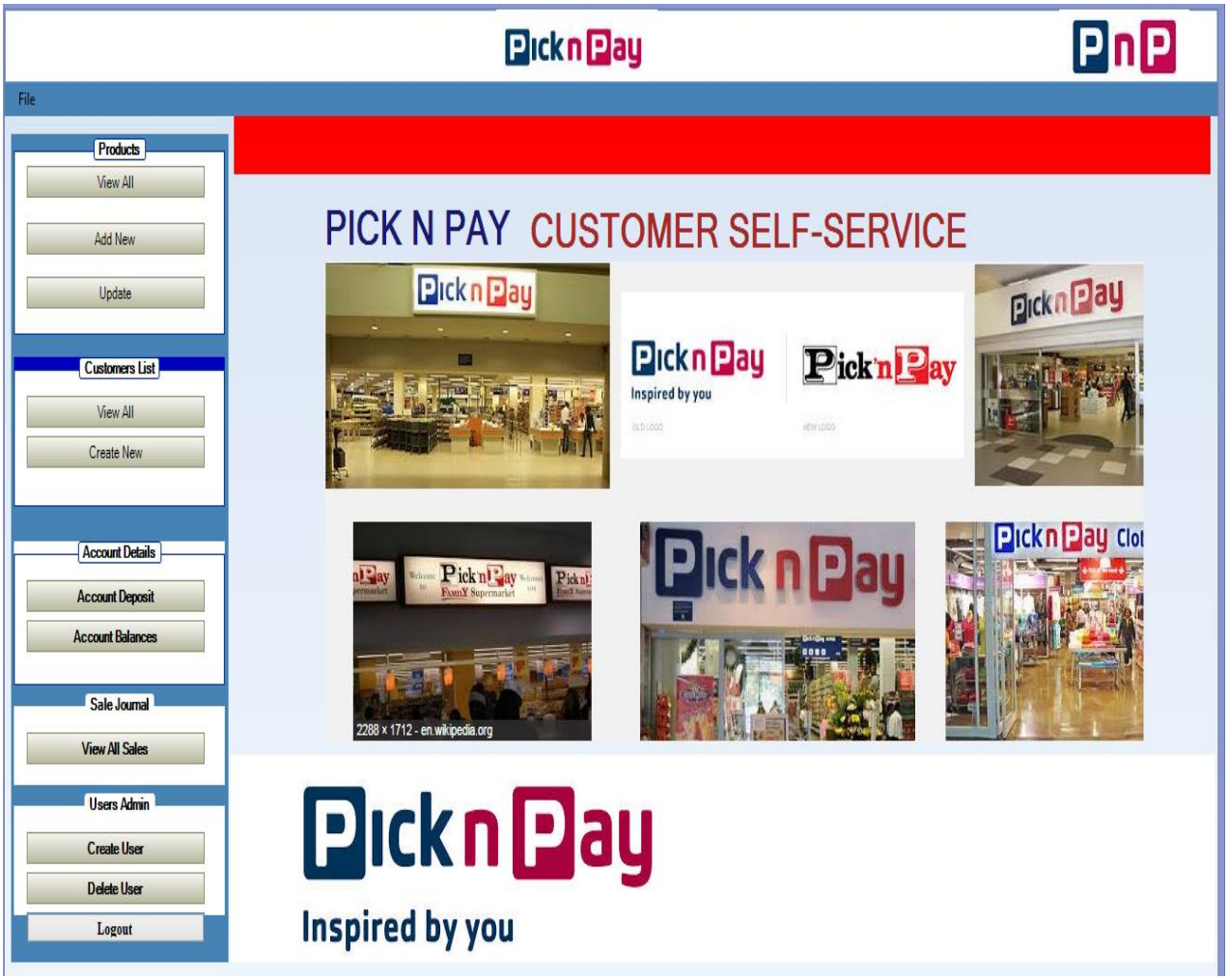


Figure 5.10: Test Case One

Test Case Two: Register Customer

Customer should be registered with personal details that is name, phone number, ID number and amount to be debited in the virtual debit card. These fields are validated to accept specified input characters. As shown in the figure below, ID should be in the format ## - ###### - D -## that is alphanumeric characters and mobile number field cannot be left null.

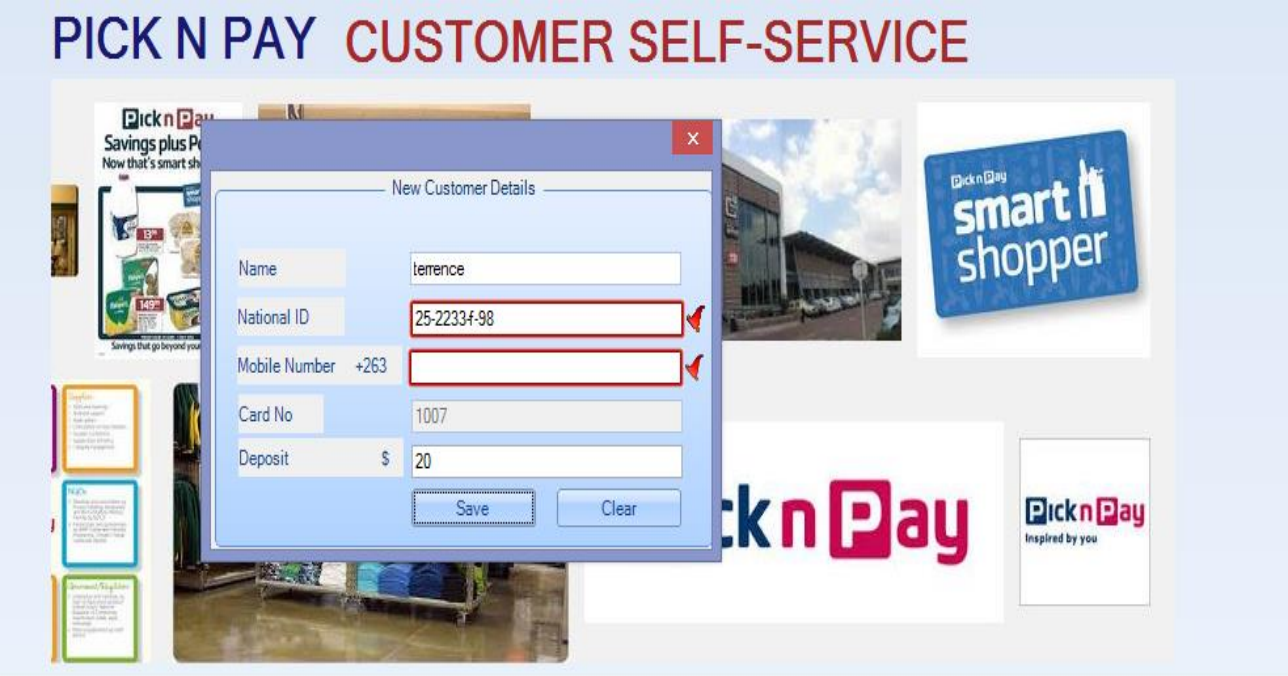


Figure 5.11: Test Case Two

Test Case Three: Adding Products

Products are added by specifying the product bar code, name price and description. This will make it easier for the customer to have full knowledge of the required products. If correct data for the product has been added, the window as shown in the figure below appears.

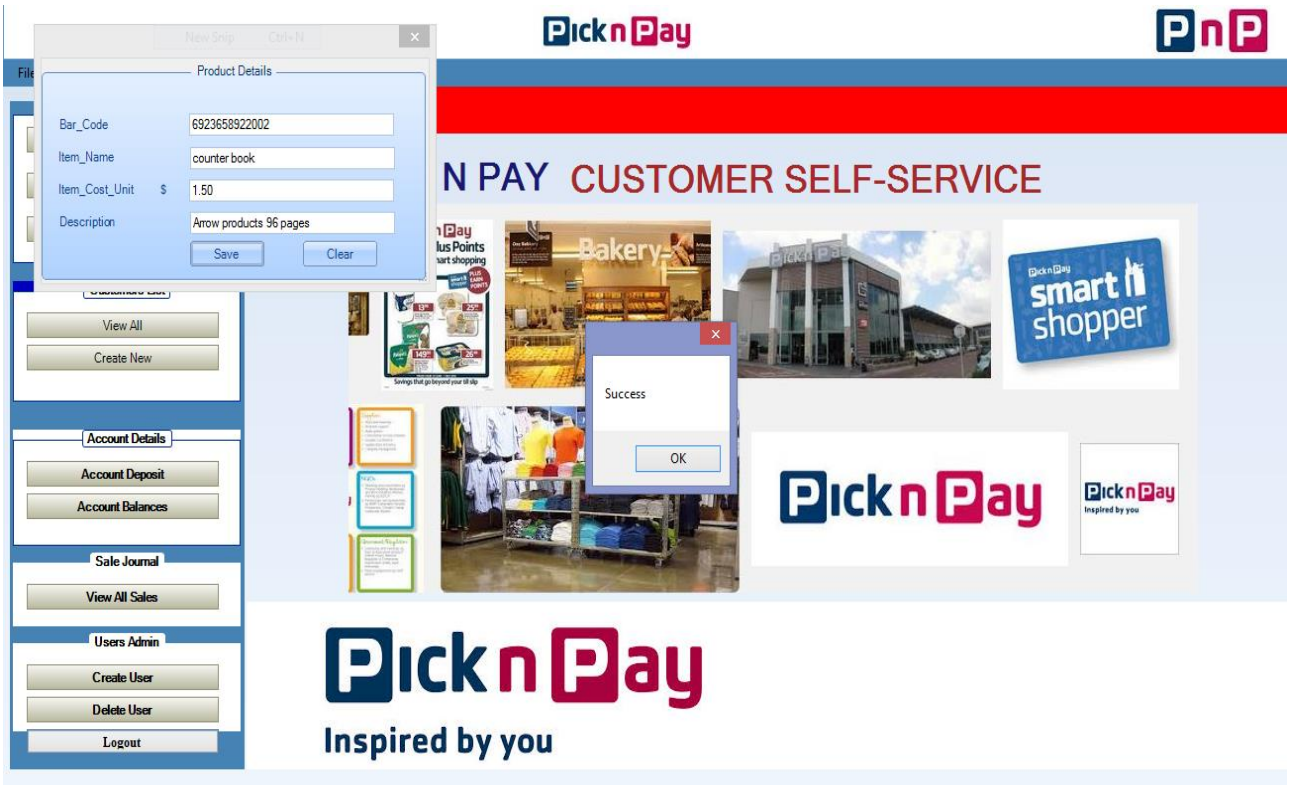


Figure 5.12: Adding Products

5.3.6.4 Verification

Main focus of system verification is to check if we developed the correct system that is meeting the specified requirements. System was checked and analyzed using program source code, requirements diagram and statics techniques. Below is the pop up message on successful login:-

5.4 INSTALLATION

Installation involves setting up the system to start executing. Windows application will be installed on the company desktops and this will be linked to the customer mobile application. Customer mobile phone will be installed with the Pick n Pay shop easy application. Configuring and installing the application includes attributes such as user training and system deployment methods and the location to where the system should installed so that it is centrally accessed by the whole organization.

5.4.1 User Training

User training involves introducing the system to all the users and making them familiarize with it. A workshop can be arranged for the internal personnel so that they have a look and feel together with a better understanding of how the system operates. Customers who are also

interested in using the mobile application can also be trained on how to use it and the application can be installed on their smart phones. This will help reduce confusion between users.

5.4.2 Operation Environment

This is the environment to which the system will operate in and the required resources for it to efficiently work. Major required components for the system to run are listed below:-

- Android platform
- Control systems
- Networking equipment
- Software configurations
- Hardware infrastructure

5.5 CONVERSION

Pardo (1992) states that this is the process were by the system is implemented after all the processes of verification, validation and testing have taken place. It involves switching from the previous way of operation to the new mobile system. This is the last step taken by Pick n Pay for the customer self-service application to be fully in use.

5.5.1 System Change Over

System changeover involves smoothly shifting from one way of business operations to another and mitigating possible disruptions in organizational activities during the changeover process. System changeover can take place in four ways that is, direct changeover, pilot, parallel and phased changeover. Changeover strategy will depend on what the organization decides after weighing the overall merits and demerits of each strategy.

5.5.1.1 Direct Change Over

This involves the total discarding of the previous system in operation and fully implementing the newly developed system therefore there will be a direct shift in operation. This strategy is the fastest to implement at the same time it has so much risk to organizational operation in the event that the new implemented system fails.

5.5.1.1.1 Merits Of Direct Change Over

- It has a clear way of implementation since it is just direct.
- No need for interface matching since the old way of operation is totally discarded.
- It is a cheaper strategy to implement since main focus is on the new system.

- There is less time taken in conversation.

5.5.1.1.2 Demerits Of Direct Change Over

- Reference to the old way of operation becomes impossible since it would have been fully discarded.
- Unavailability of backup makes the strategy risky to business operation.
- Users might be affected if a direct changeover is implemented and will eventually lead to system denial.

5.5.1.2 Parallel Change Over

This involves the simultaneous running of two system that is the old system and the new system for a specified period of time. This strategy appears to be the most appropriate because if the new system happens to fail during its operation, the organization and quickly revert to the old way of operating.

5.5.1.2.1 Merits Of Parallel Change Over

- Minimum risk as compared to direct changeover since both systems will be in operation.
- It gives room for comparative analysis on the performance and effectiveness of both systems.
- No data loss due to the availability of backup facility.
- Easy reference to information of the old system.
- It gives users the platform to compare both systems at the same time familiarizing with it without disturbing activities.

5.5.1.2.2 Demerits Of Parallel Change Over

- It is the most expensive strategy since maintenance is to be done for both systems.
- Errors are highly prone since transactions will have to be recorded twice.
- It is time consuming and labor intensive especially to personnel.
- It leads to increase in salaries and processing delays due to dual recording of data.

5.5.1.3 Pilot Change Over

This involves implementing the system in part of the organization, for example in a certain department or office. If the system is said to be a success in the pilot site, it is then implemented in the whole organization. Generally it combines two strategies that is the direct and semi-parallel changeover strategies.

5.5.1.3.1 Merits Of Pilot Change Over

- Since focus is to a specified department, it becomes easy to monitor.
- Implementation is less expensive since it is done in a specified pilot site only.
- In the event of system failure, only the pilot site is affected and not the whole organization.
- System alteration becomes easy since system will be scrutinized at the pilot site during its operation.

5.5.1.3.2 Demerits Of Pilot Change Over

- Both system interfaces needs to be integrated.
- Long conversion time.

5.5.1.4 Phased Change Over

Pusuluri (2006) postulate that this involves implementing the system in phases of different modules of the system. For example in the customer self-service application, implementation can be done to the sales and purchases then to the human resources. This will lead to the slow elimination of the old system.

5.5.1.4.1 Merits Of Phased Change Over

- Cost is low and errors are isolated
- It gives users room to get used to the system at each stage.
- In the event of system failure the whole organization is not affected.

5.5.1.4.2 Demerits Of Phased Change Over

- System implementation takes long to complete since it is done in phases.
- If the system is complex and with many phases it can be very expensive.

5.5.2 Recommended Change Over Strategy

Pick n Pay stores opted for a parallel changeover strategy since the self-service application is a totally new idea and at the same time not all customers have smart phones to scan barcodes. On the other hand some customers are elderly people and do not understand the operations of smart phones. Therefore a parallel changeover will make customers and personnel familiarize with the new system operation at the same time not reducing general sales of the organization.

5.6 MAINTANANCE

Kelly (2006) postulates that maintenance is the process of making sure that the system is performing well as expected. The process starts the moment the system is implemented and

continues throughout its use in the organization. Changes are made during system operations and these changes can be upgrades or correcting so as to meet system objectives.

5.6.1 System Review

Involves analyzing how the system operates and how it's causing changes to business operation. Modules of the system are checked for efficiency and productivity. The ICT department is responsible for maintaining and assessing the system performance. Below is a diagram that shows the stages in system review.

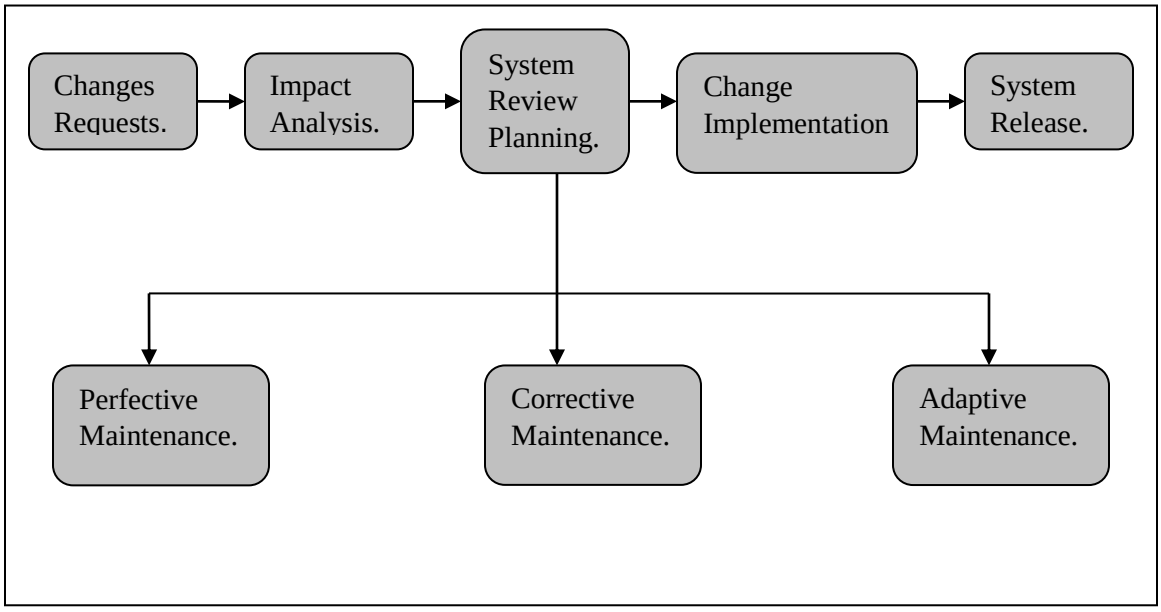


Figure 5.13: Steps In System Maintenance Activity Diagram

5.6.1.1 Perfective Maintenance

Perfective maintenance ensures that, system interface is usable, processing performance is improved and alterations that are necessary are done to system features. Main thrust of perfective maintenance is ensure that, system is maintainable, reliable, has a faster response time and is reliable. Internal users are the ones that coz a trigger to the need of system perfectiveness therefore there is need to keep track of ever changing needs of users to ensure system perfectiveness.

5.6.1.2 Adaptive Maintenance

Adaptive maintenance is the process of changing an information system so that it becomes flexible to business changing needs or migrating to a unique environment that it will operate in.

Practice of adaptive maintenance increases enhancement of a system for example, additional system features, or improvement in maintainability and efficiency.

5.6.1.3 Preventive Maintenance

This involves a proactive approach of making changes to the system with an attempt of reducing possible failures of the system in the future. The system is inspected systematically, errors are detected then they are corrected to avoid serious system failures in the future.

5.6.1.4 Corrective Maintenance

According to Flynn (2011), corrective maintenance are the changes done to correct defects in implementation, coding or design. These problems are easier to identify after implementation of the system. Once these corrective maintenance issues are identified, they have to be looked at immediately so that it won't affect the normal running of the business. Main thrust is on identifying problems and correcting them, no additional functionalities are done.

5.6.2 Disaster Recovery

Disaster recovery is the most vital aspect in system running. Data should not be lost during operation, there should be set precautions that will make it easier to retrieve data when needed therefore there should be a backup facility that will store all the operational data for the day to day running of the business.

5.6.2.1 Security

According to Solomon (2010) system security are the measures put in place to safe guard company information and avoid access of unauthorized users to confidential information in the system database. Integrity should be assured to make sure information and resources are available as they are needed. Various measures have been put in place to try and safe guard the system resources of the system and these are explained below:-

Identification of the user – this is the ability of the system to identify the user after having specified who they are through the use of user credentials.

Authentication of the user – this involves verification and validation of the user details then given access to system resources if details match the ones in the database.

Access control – this is the ability of the system to categorize user views depending on the access level given to the user. Each user has different views each time then query the system database.

Data policy – these are the relational database schemas and validation or rules set in their fields.

Data backup - data should be saved on a separate storage device for easier reference in the event of system failure.

5.6.2.1.1 Security Measures

Below are some of the security measures implemented during system development by the researcher:-

- Password should be 8 characters and passcode should be a 4 digit code.
- Access level depends with the role of each user
- Login portals are different of that of a customer and an internal user.
- Only the administrator has the rights to alter the system database.

5.6.3 System Backup

System backup ensures that there are duplicates of both the past and present data files for the sake of accidental data loss or reference purposes.

5.6.3.1 Types Of Backups

There are many system backup strategies that an organization might look at but only a few were analyzed and described below.

5.6.3.1.1 Incremental Backup

It provides a backup of files that are new from the last incremental backup. Latest changes are backed up such that when fully recovering the data, the process of restoration will need the last full backup and the incremental backups until the current restoration time. Pain reason for incremental backup is for the preserving and protecting data by the creation of copies of data basing on the different aspects of the data thus reducing backup time.

5.6.3.1.2 Full Backup

Full back up involves all files in a system being backed up for example by setting all the files as an image file on a disk. Full back up normally does not work alone, it is then followed by other back up strategies, and it is used for system restoration.

5.6.3.1.3 Mirror Backup

Mirror back up as the name says, involve backing up the original source's mirror that is, the backed up file will contain changes made to the original file. Therefore, if one deletes an original file, automatically the mirror backup is also deleted, therefore there is need for great caution when using this type of back up strategy.

Recommended Method

Researcher opted for incremental backup method since it involves regular updates and has less data duplication. It is a much faster method to implement hence it is effective and efficient.

5.6.4 System Evaluation

With system evaluation, user is now comparing objectives with the system functionality to see if all the objectives were met and to see if all problems were sold. This is a very important concept since it makes it clear to the organization that all their issues stated on the problem definition have been met.

5.6.4.1 System Vs Objectives

Objective 1

Customer should be able to add goods, manage, and alter information in cart through the use of a mobile device.

System solution

Using a mobile phone, customer is now able to add goods in the virtual basket by simply scanning the grocery barcodes and it is automatically entered in the basket the moment the add button is clicked. By clicking the view list button on the interface customer will see a list of groceries he or she added in the virtual basket. By clicking the manage button, customer can either delete or modify quantity of commodities. The various buttons and interface are shown in the figure below:-

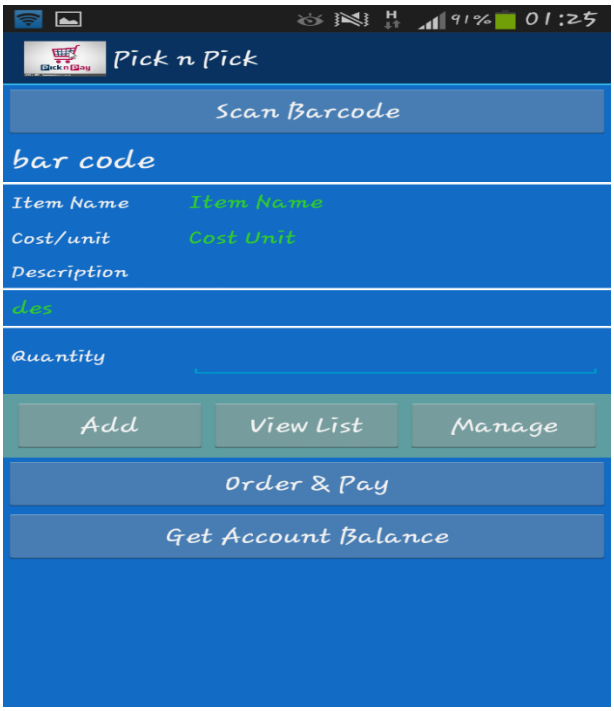


Figure 5.14: Start Shopping Interface

Upon clicking the scan barcode button, customer scans barcode of the commodity and once the barcode is captured, a window with details of the commodity pops up and this is shown below:–

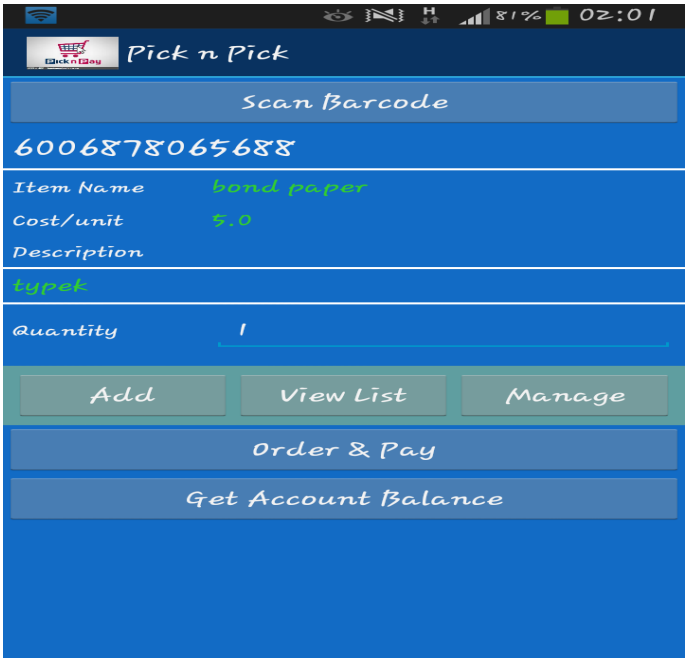


Figure 5.15: Barcode Scanner Details

On clicking the view list button, information on commodities in your virtual basket is listed as shown below:-

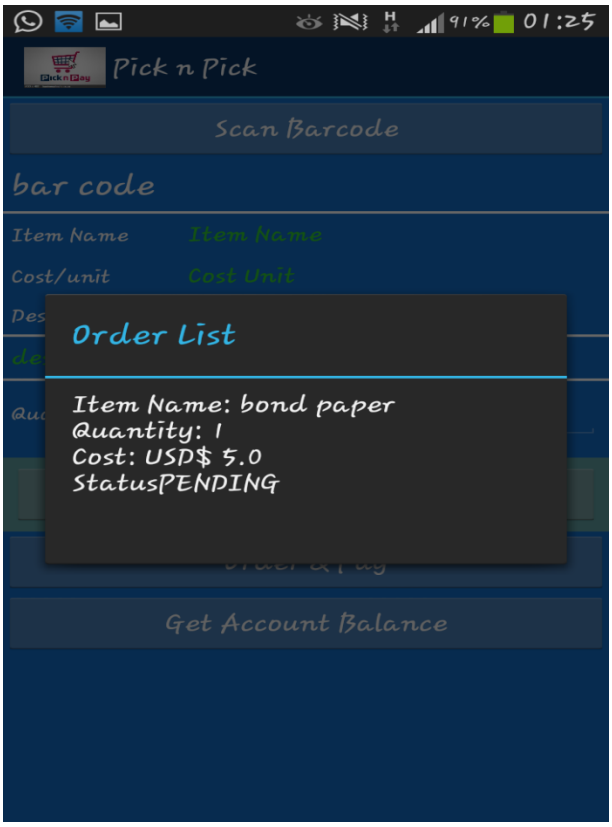


Figure 5.16: Order List

Objective 2

Making payment using Wi-Fi through the use of a mobile device

System solution

On clicking the order and pay button, customer pays for goods in her virtual basket and the amount is deducted from his or her virtual debit card. Payment information is shown below:-

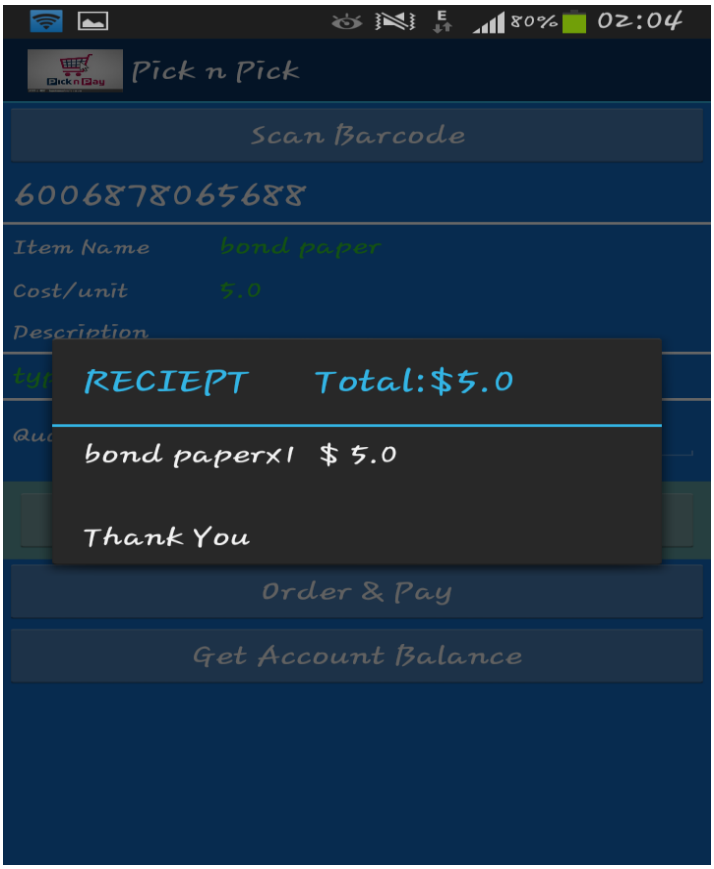


Figure 5.17: Payment Information

After payment has been done, a virtual receipt is sent to the customer in the form of a sms. The virtual receipt is as below:-

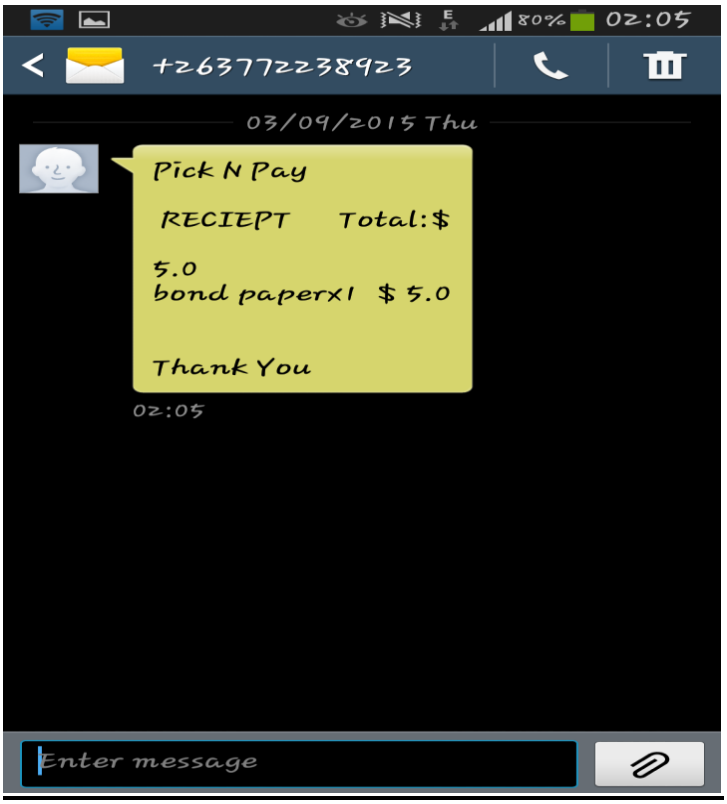


Figure 5.18: Virtual sms receipt

Objective 3

Interfacing the customer self-service mobile application and the windows application.

System solution

A link was made between the mobile application and the windows application such that if a customer purchases commodities, automatically sales journal should be updated and at the same time, customer balance should be deducted hence ensuring system integrity. Below is shows a report of the bond paper for $5 bought by a customer with card ID 1006 on 3 September 2015 at 2.04AM.

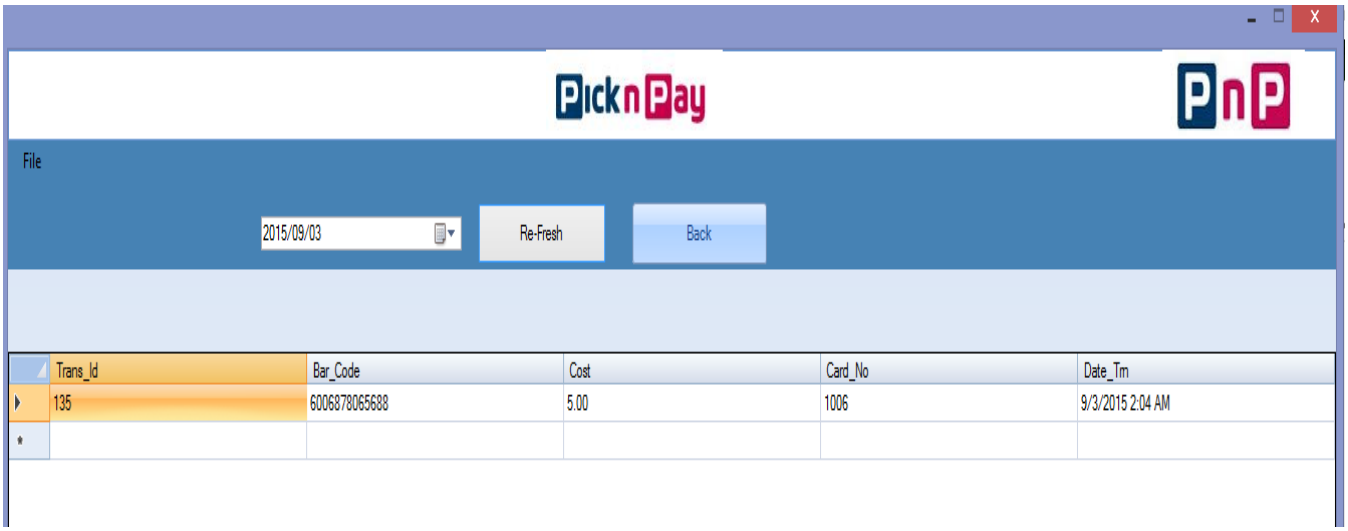


Figure 5.19: System Interfacing

Objective 4

Sales manager should be able to create and manage users and to add and manage products.

System solution

System was designed with an attempt to meet the stated objective and this is shown in the figures below:-

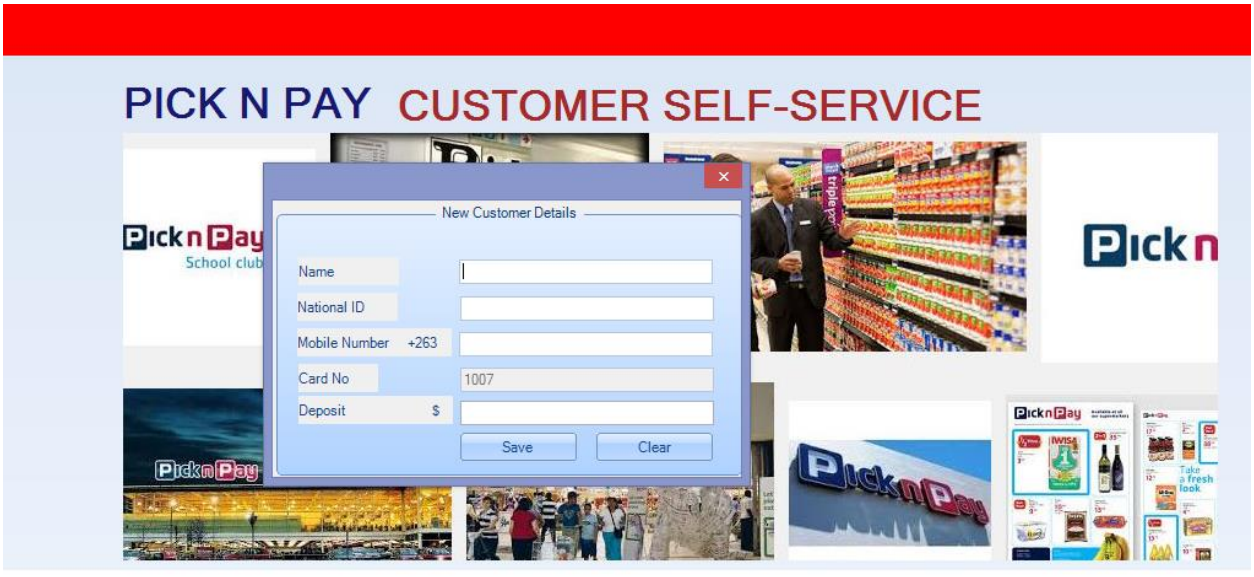


Figure 5.20: Adding New Customer

Products can be added in the system through the use of the add new products window.

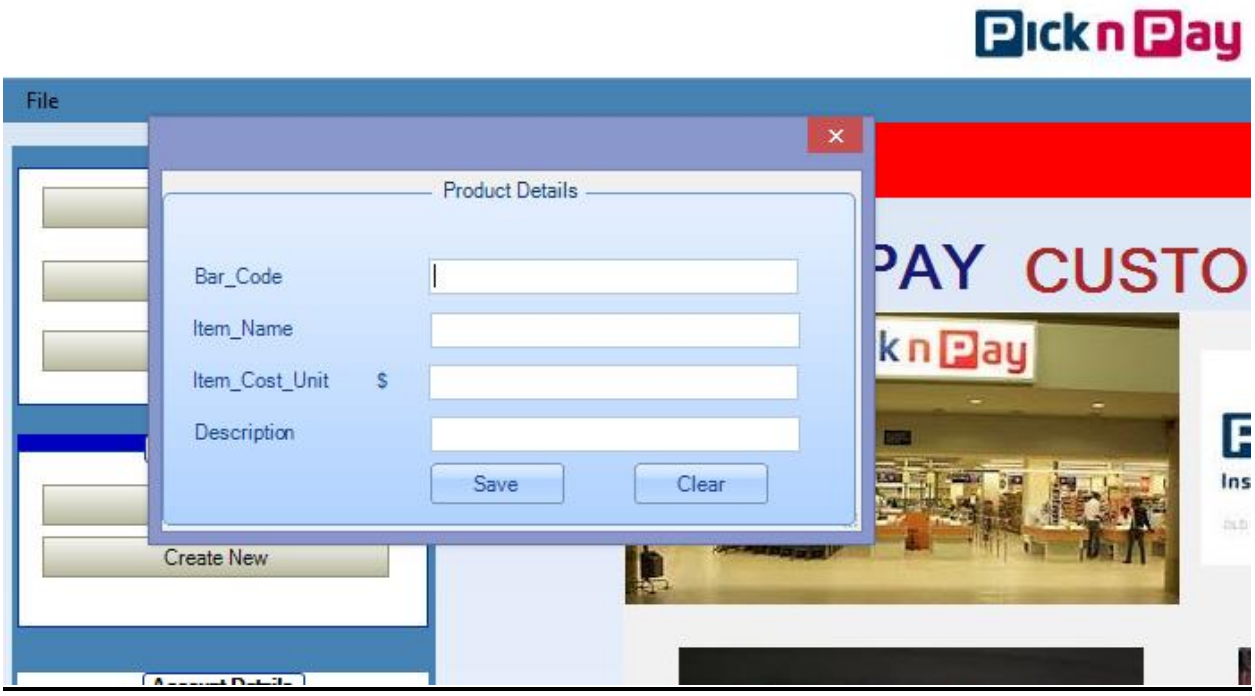


Figure 5.21: Adding New Product

Internal system users can be added in the system and this is shown in the figure below:-

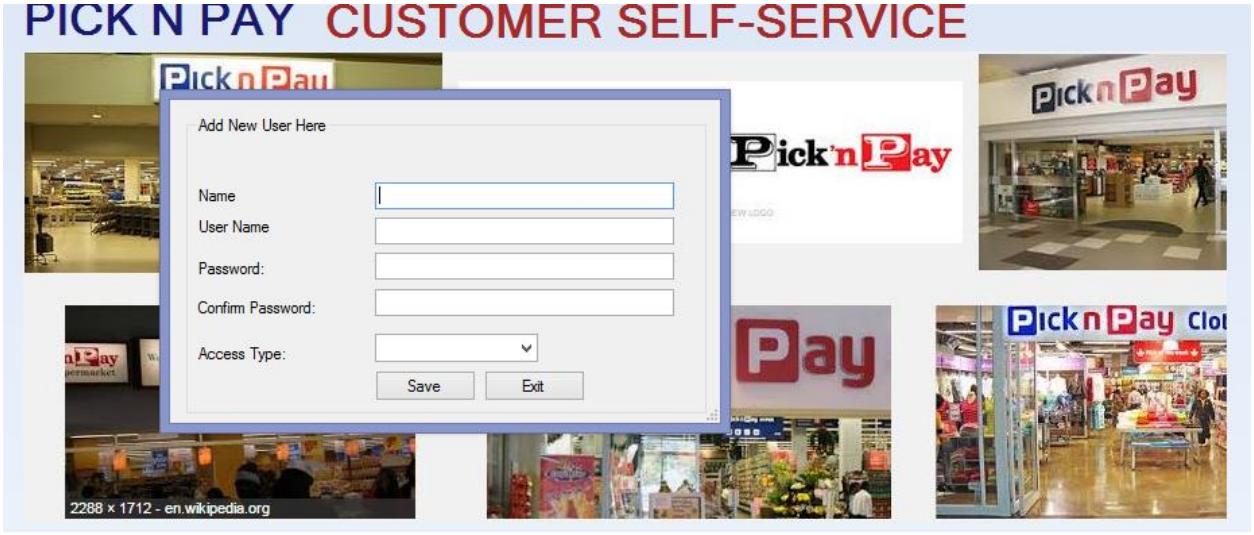


Figure 5.22: Adding New User

Products can be modified either the price or description. User simply clicks the drop down arrow and selects the barcode of the commodity to be modified.

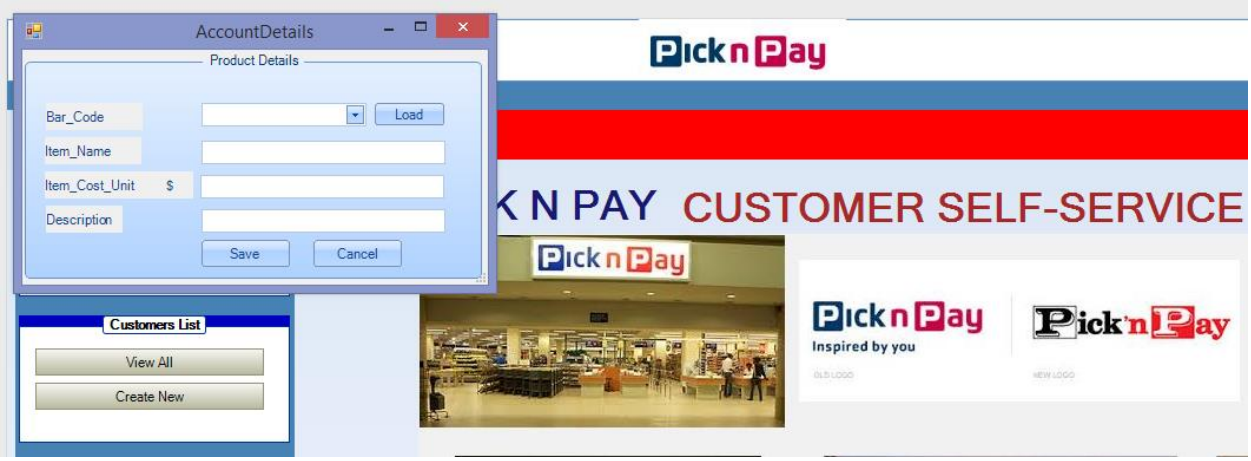


Figure 5.23: Managing Products

Objective 5 and Objective 6

Displaying of sales and customer reports and showing high spenders hence improving customer relationship management through rewarding.

System Solution

System was developed such that is shows customer and sales reports and the amounts used to purchase the products. This is shown in the form of a report as below:-

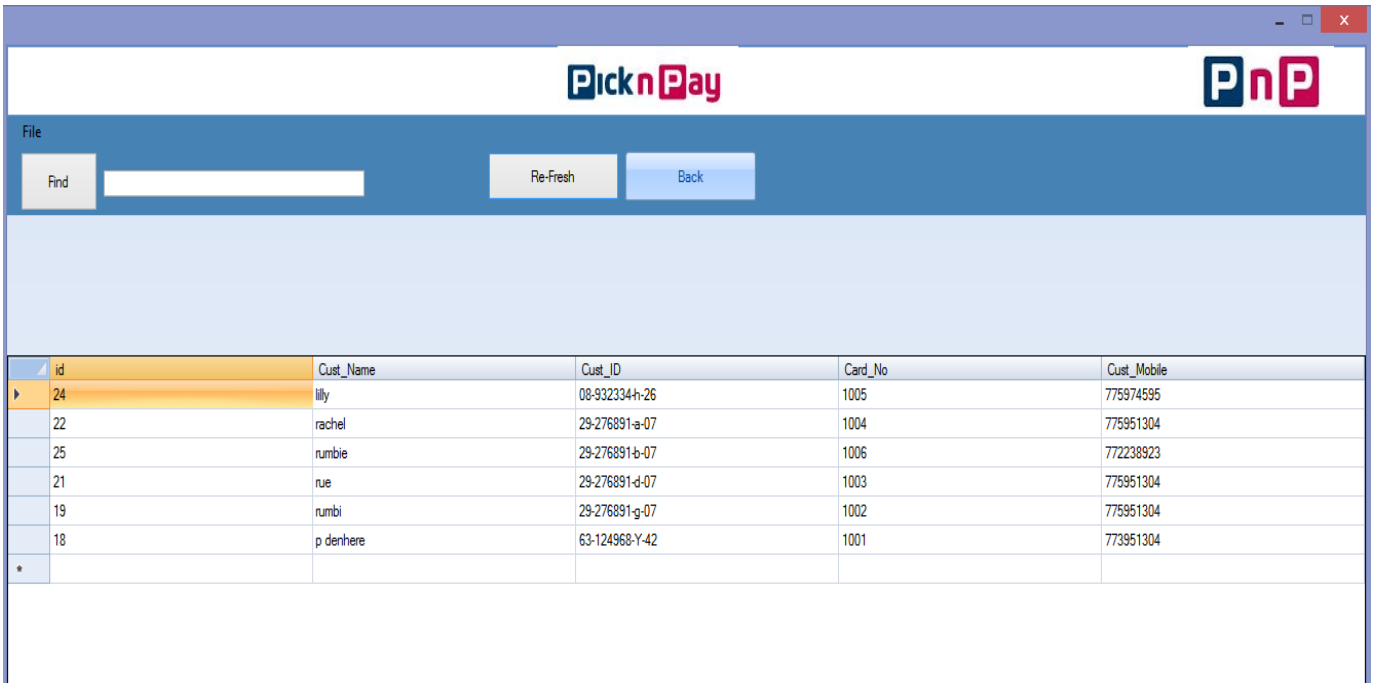


Figure 5.24: Customer Report

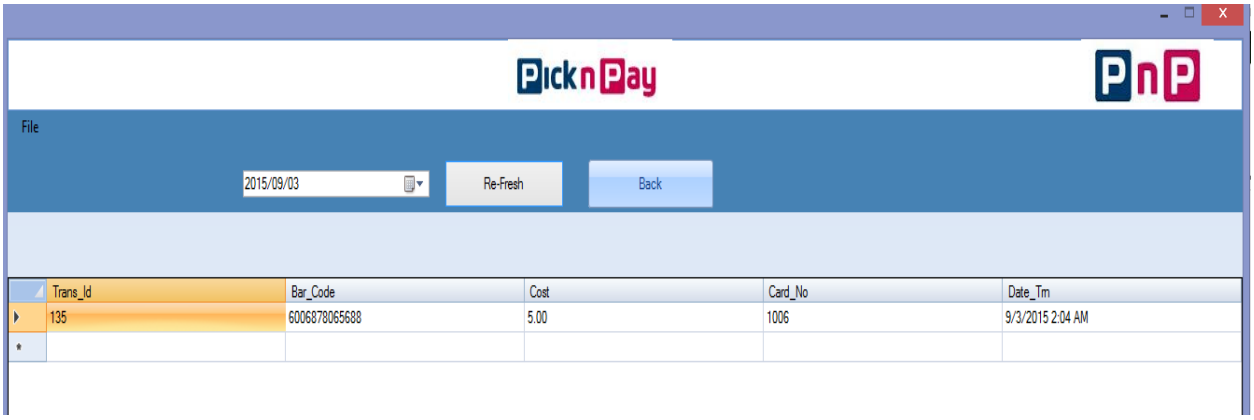


Figure 5.25: Sales Report

5.6.5 Constraints

According to Glattfelder (2012), a constraint is a factor that limits an organization from achieving its set goals at the same time minimizing progress of this stated goal. Below are a list of factors that hinder progress of the development of the customer self-service application for Pick n Pay:-

- **Time factor –** it was quite a challenge to manage time since there was need to focus on school modules at the same time, system required extra attention so as to meet deadlines.
- **Unavailability of adequate information to facilitate research –** it was difficult to acquire information from the specified personnel since most of them felt like the new system would make them lose their jobs at the same time, top management felt like some of the information was sensitive hence were maintaining company confidentiality by not saying out things as they are or not sharing the information at all.
- **Finance –** finance was a major challenge since there was need for often visits to travel to Pick n Pay for constant research and updates but this was difficult to do due to financial barriers. At the same time, there are some software and hardware infrastructural components that were required for the perfect running of the system but due to financial problems researcher had to make the best out of what is already there.

5.6.6 Recommendations

- There is need to conduct training for users to familiarize with the system.
- In future there is need to link the mobile application with customer visa cards or Eco cash debit card for payment purposes so as to avoid a routine of sales managers creating debit cards.
- There is need for system upgrades and maintenance to avoid malicious software corrupting the system and slowing down operations.
- Management recommended that the system should be merged with some of the modules of the current system for consistency.

5.7 CONCLUSION

The chapter revealed all that is necessary for a successful set up of implementation of the customer self-service application and the various security measures to be applied to secure the system from unauthorized users. The success of the project have been seen but in every successful project there are always many ways to improve its functionality than what it is. Pick n

Pay stores was impressed with the system functionality and they implemented a parallel change over strategy for the sake of user familiarization of the system before a full system implementation is done.

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APPENDIX A: USER MANUAL

Customer self-service mobile application is an android mobile application that has been developed after analyzing the existing problems at the current queuing system at Pick n Pay stores. Its development was with the sole aim of minimizing these problems and at the same time improving the technical aspects at the stores. The user manual will help users understand how the system functions and the interfaces they will see and the required information in all fields.

GENERAL REQUIREMENTS OF THE SYSTEM

For the system to become interactive, firstly user training is required so that they familiarize with the system and its function. Then after user training, user accounts should be created so as to allow users to interact with the system and query information depending with access levels.

ADMINISTRATOR AND SALES REPRESENTATIVE LOGIN

Login is the main form that the user sees the moment the system is run and it allows the user to enter his username and password that is in the case of the windows application. Below is the login window of the windows based application.

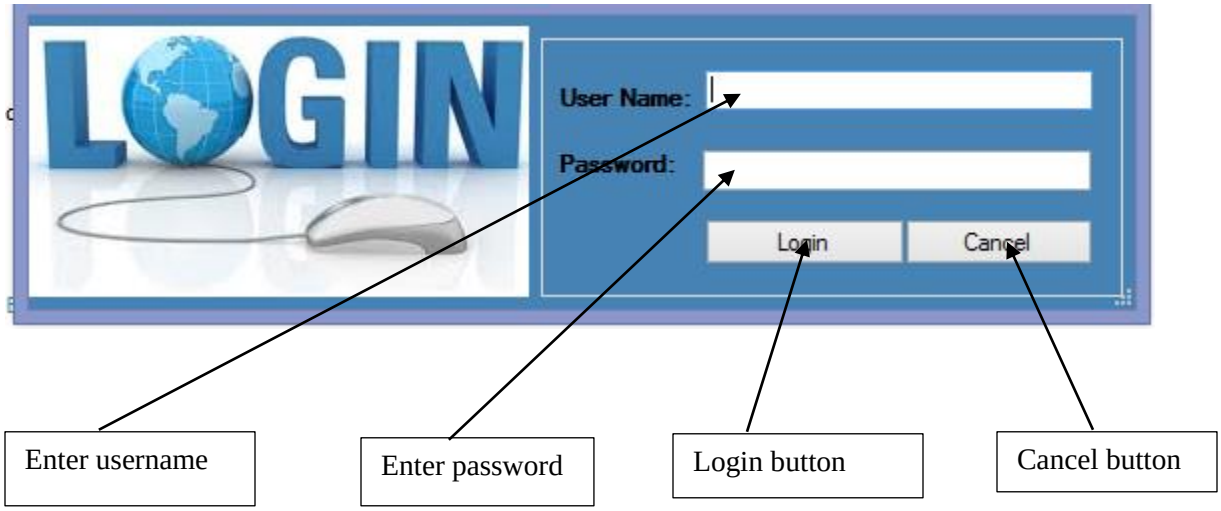

Figure A1: Login window

If user inputs incorrect credentials, the following window pops up:

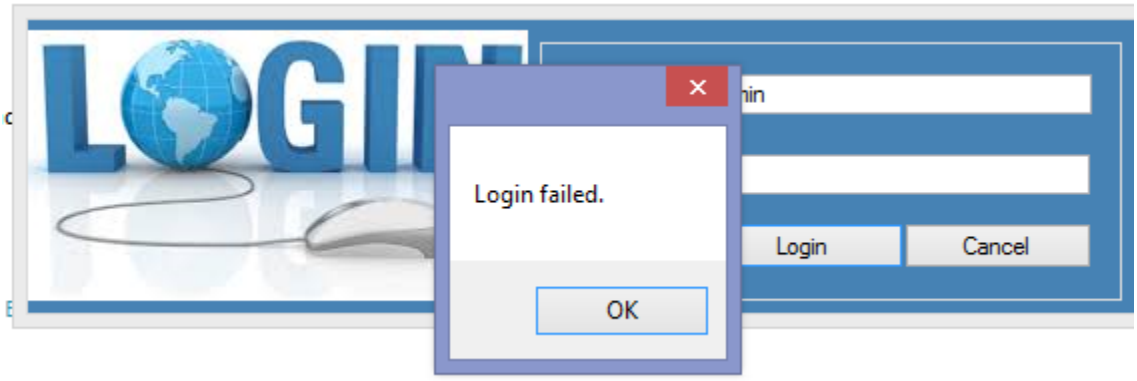

Figure A2: Wrong username and password

Below is a window that appears if the administrator logs in successfully. The same window also appears on the side of the sales rep but the only difference is that the sales rep does not have the create user and delete users.

Figure A3: Administrator menu

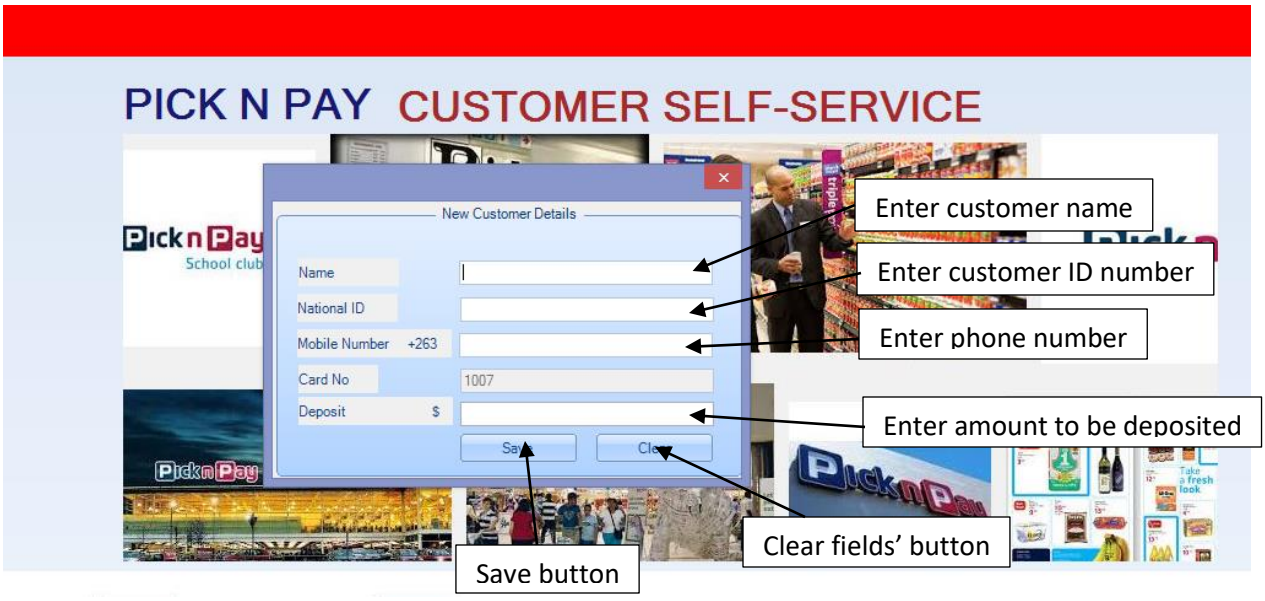

Figure A4: Creating customer account

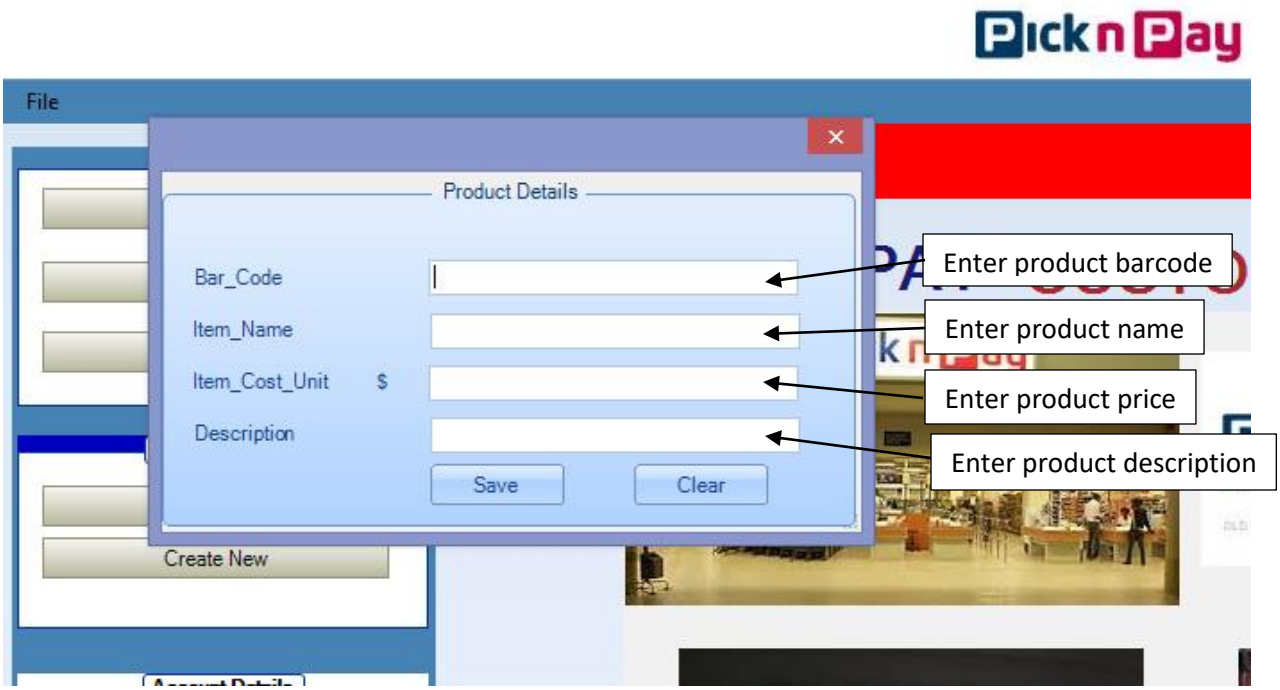

Figure A5: Adding products

Figure A6: Adding new user

The customer login portal on the mobile phone is different from that of the windows application. It requires the customer to enter his or her virtual card number and pin code. The figure is shown below.

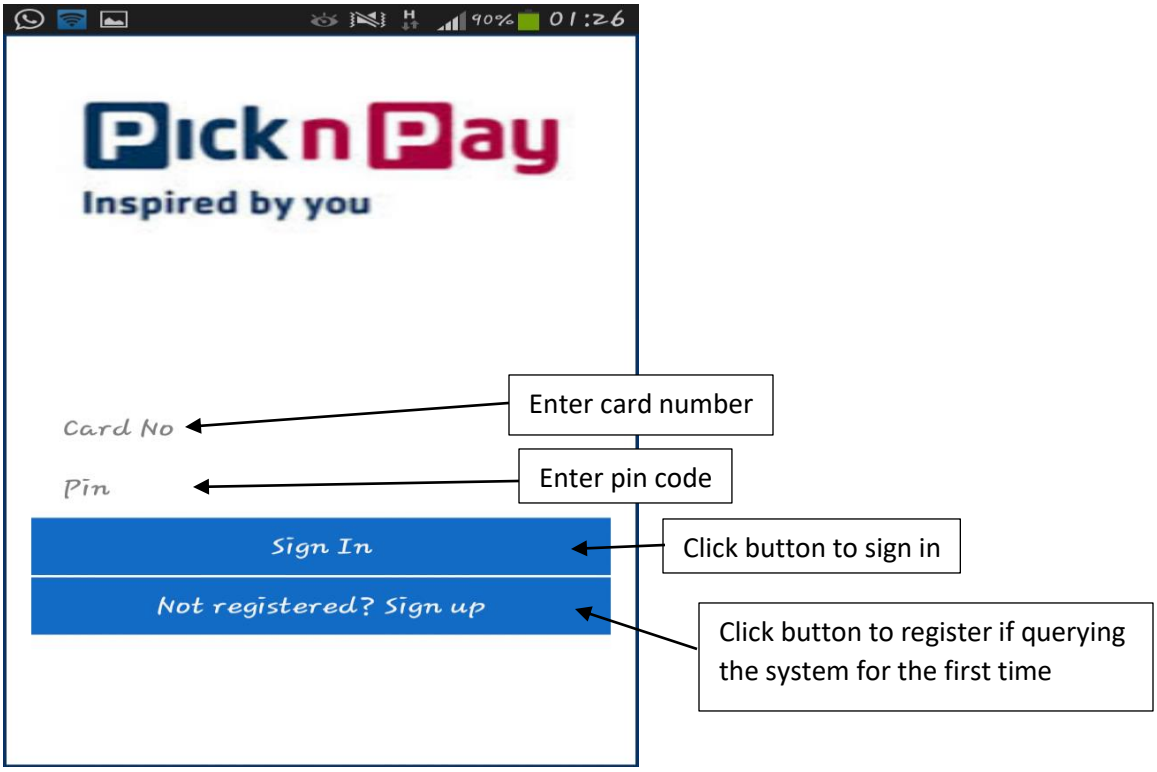

Figure A7: Customer login

This is the main menu that appears after customer has signed in.

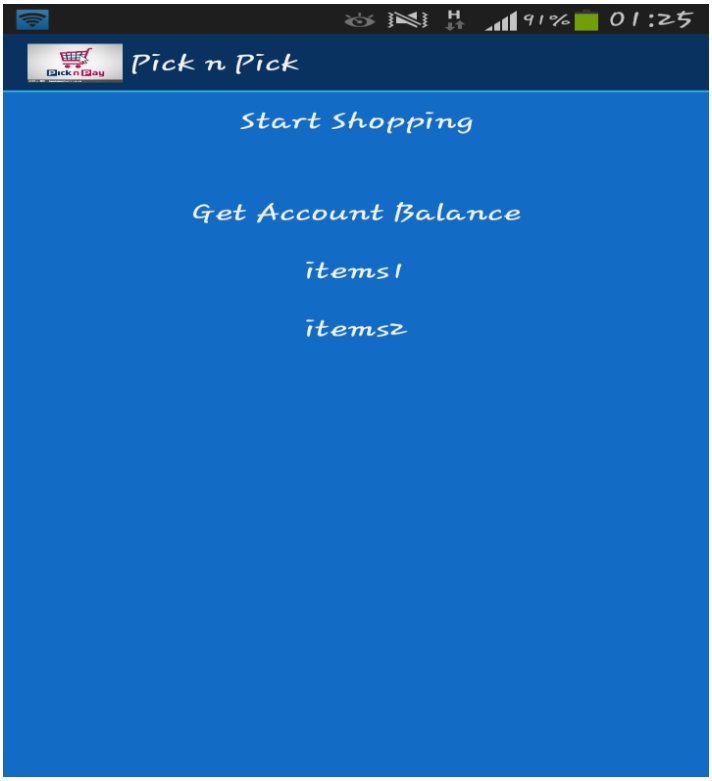

Figure A8: Customer menu

After the user clicks start shopping the window below then appears.

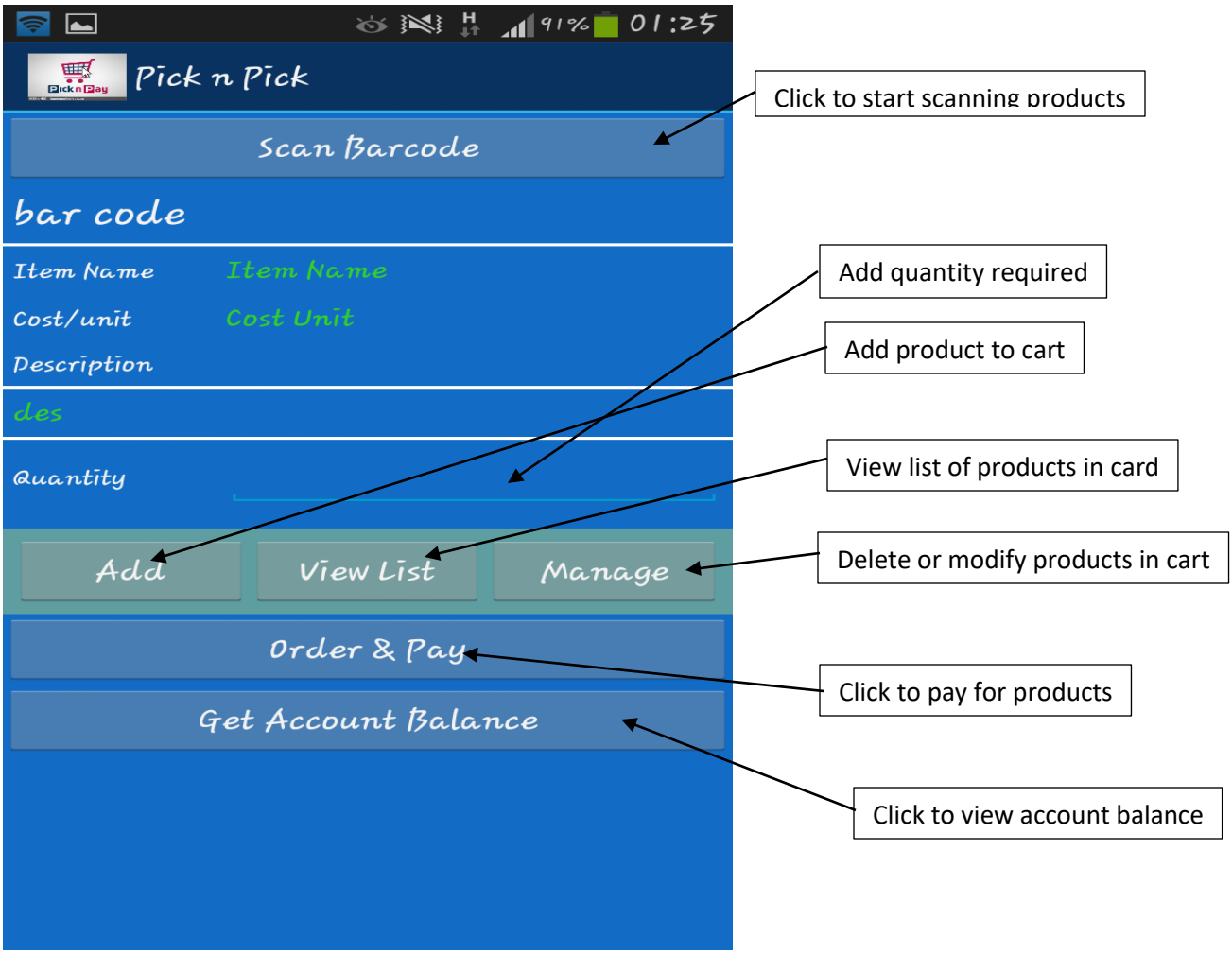

Figure A9: Shopping interface

After product bar code has been scanned the following window with product details appears and user has to specify the quantity of the product required.

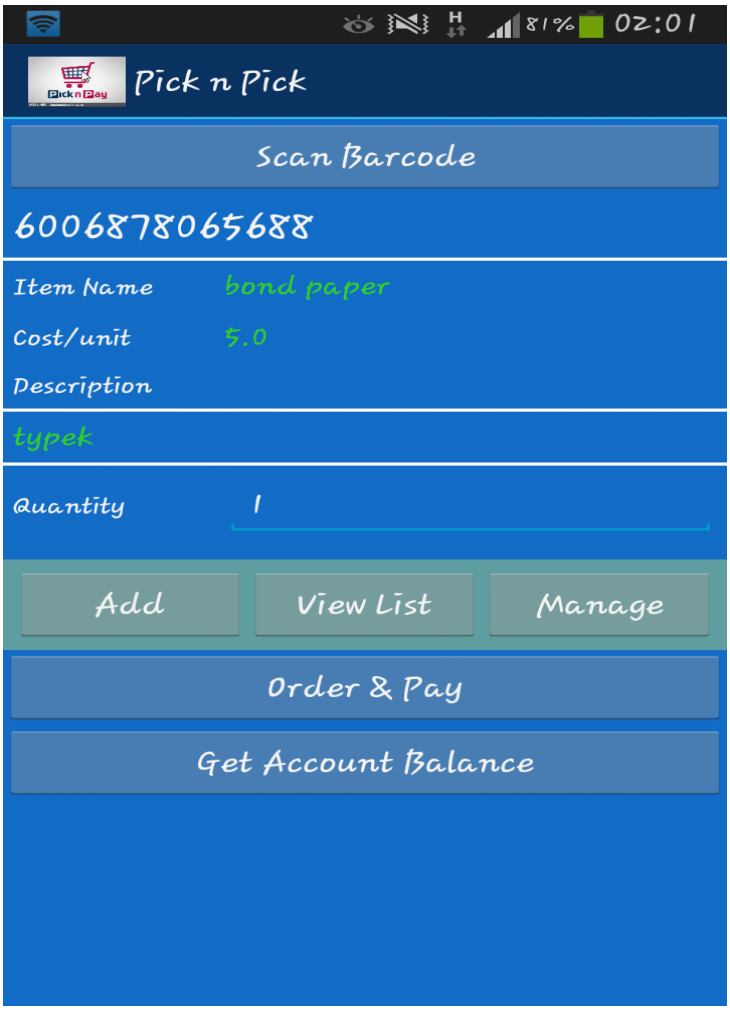

Figure A10: Product results after scanning

APPENDIX B: INTERVIEW CHECKLIST

INTERVIEW QUESTIONS

1. How do you view the performance of the current system at Pick n Pay?

2. What is your view and suggestion in implementing the customer self-service mobile application?

3. During times when there are more customers for example during festive season how do you cope up with the pressures and is the system able to quickly update its database concurrently without any errors striking?

4. Are there any controls that you would like to include in the event that an implementation of the self-service application is done?

5. Who monitors the current system and direct linkage is to who?

6. Are there enough resources that will support in the running of the system in the event that we decide to implement it?

7. What are the major disadvantages that you are facing in the operation of the current buyer system and do you have any possible solutions that you can think of to curb these problems?

8. Do you have any suggestions or additions that you would wish to include in order to improve proposed system performance?

APPENDIX C: QUESTIONNAIRE

QUESTIONS DIRECTED TO ICT DEPARTMENT

What do you expect from the implementation of the customer self-service application and do you see it as a means to increase business value in its operation?

_____
_____
_____

Will the proposed system meet business objectives? Give supporting reasons if yes or no.
_____
_____
_____
_____

Are there any further ICT technologies you would wish to integrate into the operations of this customer self-service mobile application?

_____
_____
_____
_____

Due to the ever-changing technologies, a suggestion was given to change the system from the current to the customer self-service application. What are your views toward the proposed system?

_____
_____
_____
_____

ANSWER BY TICKING YES OR NO

QUESTION	YES	NO
1. Do you think the proposed system is better than the current system		
2. Do you think the proposed system will be beneficial in the future?		
3. Will the proposed system help increase sales?		
4. Are the company objectives being met by the current system?		
5. Will the proposed system pave way to development of new		

technologies?		

ADMINISTRATION DEPARTMENT

1. How do you rate the current system?

   Excellent ☐ Good ☐ Fair ☐ Poor ☐

2. Would you opt for mobile solutions if considered as a candidate from migrating from the current system?

   Yes ☐ No ☐

   If **No,** what may be the reason_____
   _____

3. Do you often experience a system delay during busy days of operation?

   Very often ☐ Sometimes ☐ All the time ☐

4. Have some of employees or customers complained about the current system's performance?

   Yes ☐ No ☐

   If **YES** what were the complaints?

   _____

APPENDIX D: OBSERVATION FORM

OBSERVATION SCORE SHEET

Name of observer: _____

Area under observation: _____

Date: _____ Time: _____

Focus of observation: _____

Brief description of session:-

_____
_____
_____
_____
_____
_____

Areas of strength:-

_____
_____
_____
_____
_____

Comments:-

_____
_____
_____
_____

Signature: Manager_____ Date: _____

Signature: Observer_____ Date: _____

APPENDIX E: SAMPLE CODE

Personnel login

```
    public partial class login : Form
    {
        connector con = new connector(); Boolean admin = false;
        public login()
        {
            InitializeComponent();
        }

        private void button1_Click(object sender, EventArgs e)
        {
            Boolean logged = false;
            con.connectiondb();
            string sql = "select * from usersadmin ";
            con.cmd = new SqlCommand(sql, con.cnn);
            con.reader = con.cmd.ExecuteReader();
            while (con.reader.Read())
            {
                if ((textBox1.Text ==
CryptorEngine.Decrypt(con.reader.GetString(0),true)) && (textBox2.Text ==
CryptorEngine.Decrypt(con.reader.GetString(1),true)))
                {
                    logged = true;
                   if(con.reader.GetString(2) =="Admin"){
                       admin = true;

                   }
                }
            }
            if (logged)
            {
                this.Hide();
                MessageBox.Show("Login successfull.");
                Form1 fm = new Form1(admin);

                fm.ShowDialog();
                this.Close();
            }
            else { MessageBox.Show("Login failed."); }

        }
```

Adding new user

```
public partial class addUser : Form
    {
        connector con = new connector();
        public addUser()
        {
            InitializeComponent();
        }

        private void button1_Click(object sender, EventArgs e)
        {
            if (!superValidator1.Validate()) { return; }

            if (textBox1.Text == "" || textBox2.Text == "" || textBox3.Text == "" ||
textBox4.Text==""||comboBox1.Text =="") { MessageBox.Show("Please complete"); return; }
            if (!textBox2.Text.Equals(textBox4.Text)) { MessageBox.Show("Passwords do not
match"); return; }
            try
            {
                con.sql = "insert into usersadmin values('" +
CryptorEngine.Encrypt(textBox1.Text,true) + "','" +
CryptorEngine.Encrypt(textBox2.Text,true) + "','" + comboBox1.SelectedItem.ToString() +
"','" + textBox3.Text + "')";
                if (!con.ExecuteSQLQuery(con.sql)) { MessageBox.Show("User already
exists");return;}
                MessageBox.Show("User Created Successfully.");
            }
            catch(Exception ex)
            {
                MessageBox.Show(ex.Message);
            }
        }

        private void button2_Click(object sender, EventArgs e)
        {
            superValidator1.Enabled = false;
            this.Close();
        }
    }
}
```

Adding new product

```
if (!superValidator1.Validate()) { return; }
            connector con = new connector();
            con.sql = "insert into
Product(Bar_Code,Item_Name,Item_Cost_Unit,Item_Description) values('" + barcode.Text +
"','" + itemname.Text + "','" + cost.Text + "','" + desc.Text + "')";
            if (con.ExecuteSQLQuery(con.sql))
            {
                MessageBox.Show("Success");
            }
            else {
                MessageBox.Show("Failed to Load record. Make sure the product does not
exist already");
            }



        }

        private void buttonX2_Click(object sender, EventArgs e)
        {
            barcode.ResetText();
            itemname.ResetText();
            cost.ResetText();
            desc.ResetText();

            superValidator1.ClearFailedValidations();
        }

        private void barcode_TextChanged(object sender, EventArgs e)
        {

        }

        private void itemname_TextChanged(object sender, EventArgs e)
        {

        }
    }
}
```