



University of Fort Hare
Together in Excellence

**Implementation of a rewards-based negotiation
module for an e-Commerce platform**

A thesis submitted in fulfillment of the requirements for the
degree of

Master of Science

in

Computer Science

by

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Declaration

I, the undersigned, declare that the work contained in this dissertation is my own original work. I acknowledge that all references are accurately recorded and that, unless otherwise stated, all work herein is my own.

Signature.....

Date.....

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Abstract

Information and Communication Technologies (ICTs) have been widely deployed in developmental programs and this has led to the creation of a new field – ICT for Development (ICT4D). Within the context of ICT4D, various e-services are being developed, including e-Commerce, e-Government, e-Health and e-Judiciary. ICT4D projects allow Small, Medium and Micro Enterprises (SMMEs) in rural areas to increase sales and gain a market share in the global market. However, many of these ICT4D projects do not succeed, because they fail to bring enough financial value to SMMEs due to the form they currently have. An obvious example is e-Commerce, which should be a source of revenue for business organizations, but most often is not.

This thesis presents the design and implementation of a rewarding and negotiation application for a shopping portal to improve the marketing of products for rural entrepreneurs. The shopping portal has been set up for the Dwesa community, a marginalized area in the Eastern Cape province of South Africa. The proposed system, called the Dwesa Rewarding Program (DRP) enables customers buying online to get points for some of the activities carried out on the shopping portal. It also allows customers to negotiate and make offers whilst purchasing and get rewarded for buying online. The novelty of the system is in its flexibility and adaptability. One achievement of this system is the establishment of negotiation rules which allows fairness in rewarding customers. This should in turn lead to increased sales on the e-Commerce platform in marginalized areas and subsequently increased effectiveness of ICT4D for socio-economic development.

Publications related to the work reported in this thesis

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Acronyms

AI	Artificial Intelligence
CSS	Cascading Style Sheets
DHTML	Dynamic Hyper Text Markup Language
DRP	Dwesa Reward Program
FTP	File Transfer Protocol
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
ICT	Information and Communications Technology
ICT4D	ICT for Development
LAMP	Linux, Apache, MySQL, PHP
PHP	Personal Home Page
SLL	Siyakhula Living Lab
SMME	Small to Medium Micro Enterprises
UML	Unified Modeling Language
URL	Uniform Resource Locator

TABLE OF CONTENTS

CHAPTER 1: RESEARCH INTRODUCTION	1
1.1 Introduction	1
1.2 Project context	2
1.3 Problem statement.....	2
1.4 Aim and objectives of the project	3
1.4.1 Specific system functionality.....	5
1.4.2 Expected system benefits.....	5
1.5 Motivation and contribution of research	5
1.6 Structure of this thesis	6
1.7 Conclusion.....	7
CHAPTER 2: ICT4D AND E-COMMERCE PLATFORMS IN MARGINALIZED AREAS.....	8
2.1 Introduction	8
2.2 ICT for Development in marginalized areas	9
2.2.1 ICT for Development (ICT4D) in South Africa.....	10
2.2.2 Siyakhula Living Lab (SLL).....	12
2.3 e-Commerce platforms in marginalized areas.....	14
2.3.1 Selling in marginalized areas.....	15
2.3.2 Challenges affecting e-Commerce platforms	17
2.3.3 Improving e-Commerce projects	19
2.3.4 Customer loyalty programs through rewarding applications	19
2.3.5 e-Marketing in Marginalized Areas.....	20
2.3.6 Technologies and securing e-Commerce systems	22
2.4 Relevant case studies.....	23
2.4.1 ABSA Rewards.....	23

2.4.2 Best Buy Rewards Program.....	24
2.4.3 ProductCart’s Reward Points.....	25
2.4.4 O-Cham Reward Program	26
2.4.5 Vodacom Rewards program	26
2.4.6 Aroxo Negotiation Application	27
2.5 Analysis of case studies	29
2.6 Conclusion.....	30
CHAPTER 3: DWESA REWARDING MODULES	31
3.1 Introduction	31
3.2 buy at Dwesa methodologies and technologies	31
3.2.1 System back-end technologies.....	34
3.3 Analysis of the rewarding modules.....	37
3.3.1 Points allocation module	37
3.3.2 Negotiation Overview.....	38
3.3.3 Rewarding Customers.....	41
3.4 Dwesa Rewards Program user roles.....	43
3.4.1 Administrators’ Roles.....	43
3.4.2 Shop Owners’ Roles	44
3.4.3 Customers’ Roles.....	44
3.5 Conclusion.....	48
CHAPTER 4: DWESA REWARDING PROGRAM NEGOTIATION MODULE	49
4.1 Introduction	49
4.2 Negotiation Architecture	51
4.3 Negotiation Process	53
4.4 Negotiation Context and negotiation goal.....	56
4.5 Negotiation strategies.....	57

4.6 Negotiation Rules.....	58
4.7 Analysis of Negotiation factors	61
4.8 Conclusion.....	62
5.1 Introduction.....	63
5.2 System Architecture.....	63
5.3 Rewarding Modules objects	65
5.3.1 Customer Class.....	67
5.3.2 Shop Class	67
5.3.3 Item Class	68
5.3.4 Customer in a mall class.....	68
5.3.5 Shop Owner	68
5.4 Database Design.....	69
5.4.1 User Information.....	70
5.4.2 Cart Details	71
5.4.3 Points Details	71
5.4.4 Negotiation Factors.....	72
5.5 Rewarding application development	73
5.5.2 Back-end interfaces	77
5.6 Conclusion.....	80
CHAPTER 6: REWARDING MODULES LOW- LEVEL IMPLEMENTATION.....	81
6.1 Introduction	81
6.2 Client-server communication via HTTP protocol.....	81
6.2.1 GET Method.....	81
6.2.2 POST Method.....	82
6.2.3 State maintenance	82

6.3 Back-end implementation.....	90
6.4 System security	96
6.4.1 User interaction.....	96
6.4.2 Authentication of the user.....	96
6.4.3 Negotiation Security	97
6.5 Conclusion.....	98
CHAPTER 7: SYSTEM TESTING, EXPERIMENTATION AND EVALUATION	99
7.1 Introduction	99
7.2 Testing of the system.....	99
7.2.1 Unit test.....	99
7.2.2 Usability Testing.....	100
7.2.3 Usability System testing to the shop owners	100
7.2.4 Usability system to the customers	104
7.3 Discussion on overall system performance	108
7.4 Factors affecting system performance.....	110
7.4.1 Payment method	110
7.4.2 Postal system for distribution	110
7.4.3 Messaging service.....	110
7.5 Conclusion.....	111
CHAPTER 8: SUMMARY, DISCUSSION AND CONCLUSION	112
8.1 Introduction	112
8.2 Summary	112
8.3 Achievements	113
8.4 Status of the deployed DRP shopping portal	114
8.5 Limitations and Future work.....	114
8.5.1 Limitations.....	114

8.5.2 Future work.....	115
8.6 Overall conclusion.....	116
REFERENCES.....	117
APPENDIX A: USER MANUAL	127
APPENDIX B: SAMPLE QUESTIONNAIRE	131
APPENDIX C: REWARDING PROGRAM QUESTIONNAIRE.....	134
APPENDIX D: SYSTEM INSTALLATION.....	137

List of Figures

Figure 1 Aroxo Thermometer	27
Figure 2 Making a Negotiation Decision	28
Figure 3 <i>buy at Dwesa</i> Main page	32
Figure 4 Negotiation Application	40
Figure 5 Buying and Rewarding Process	42
Figure 6 Shop Owner Roles	44
Figure 7 Customer Roles	45
Figure 8 Customer Roles	46
Figure 9 Customer buying sequence	47
Figure 10 Customer making offer sequence diagram	48
Figure 11 Negotiation Process	53
Figure 12 Negotiation Counter-offers	54
Figure 13 Negotiation Control Module	55
Figure 14 System Architecture	64
Figure 15 DRP Class Diagram	66
Figure 16 Database Models	69
Figure 17 Customer Interface	73
Figure 18 Customer viewing points	74
Figure 19 Cart Details	74
Figure 20 Customer Offers	75
Figure 21 Customer offer too low	76
Figure 22 Customer offer accepted	76
Figure 23 Shop owner interface	77
Figure 24 Uploading items	78
Figure 25 Shop owner viewing points	79
Figure 26 Setting negotiation factors	80
Figure 27 All Customers Points details	85
Figure 28 Number of attempts left for negotiation	87
Figure 29 System counter-offer	88

Figure 30 Uploading items.....	90
Figure 31 Editing items.....	91
Figure 32 Updating negotiation factors	92
Figure 33 Negotiation factor rating.....	102
Figure 34 Negotiation factor levels.....	103
Figure 35 Negotiation Factors for customers.....	104
Figure 36 Negotiation results (a)	106
Figure 37 Negotiation factors (b).....	107

List of Listings

Listing 1 POST Method	82
Listing 2 Session management.....	83
Listing 3 Getting customer details	83
Listing 4 Displaying cart items	84
Listing 5 Viewing points.....	84
Listing 6 Clicking Negotiation button	86
Listing 7 Getting negotiation factors	86
Listing 8 Offer validation.....	87
Listing 9 The shaded bar displayed when validating offers	89
Listing 10 Processing Negotiation factors	89
Listing 11 Uploading an item	90
Listing 12 Selecting factors	92
Listing 13 Negotiation process	93
Listing 14 Getting activated factors	93
Listing 15 Validating offers	94
Listing 16 Calculation of final price	94
Listing 17 Counting of No. of attempts left for negotiation	95
Listing 18 Validation of username during registration	96
Listing 19 Selecting user role	97
Listing 20 Old system size	108
Listing 21 New system size	109
Listing 22 Old Database system size	109
Listing 23 New database size.....	109

List of Tables

Table 1 South African Departments in ICT	11
Table 2 Best Buy Rewards.....	24
Table 3 Negotiation factors.....	60
Table 4 User details	70
Table 5 Cart details	71
Table 6 Points details	71
Table 7 Items details	72
Table 8 Negotiation factors.....	72
Table 9 Active negotiation factors	105
Table 10 Users' Negotiation details	105
Table 11 Customer Negotiation Traits.....	106

List of Formulas

Formula 1 For buyers and sellers.....	51
Formula 2 Validating offer	59
Formula 3 Acceptable price	60
Formula 4 Low offer.....	60

CHAPTER 1: RESEARCH INTRODUCTION

This chapter provides background information on the implementation of a reward-based negotiation module for e-Commerce platforms. It explains the reasons for implementing the system and states the contribution of rewarding customers buying from the Dwesa community.

1.1 Introduction

Small, Medium and Micro Enterprises (SMMEs) have increased in rural communities and thus enabled rural entrepreneurship. As of 1998, Terry Neese in LI Business News found that, about 20 percent of small businesses globally (defined as those having fewer than 500 employees) were located in rural areas (Answers.com, 2009). SMMEs have enabled the sustainability of ICTs in rural areas and the percentage growth has been increasing. As a result, e-Commerce applications are being developed to allow the growth of SMMEs and ICTs in rural communities (Jere *et al.*, 2009a; Wertlen, 2007). The growth of e-Commerce in rural communities has led to the development of different ways of selling products. These selling methods have enhanced e-Marketing applications in rural communities. SMMEs are now using innovative ways such as selling online and offering rewards and incentives to customers buying online (Miller, 2008). These marketing strategies have improved the services and products of rural entrepreneurs. Therefore, continuous support of ICTs in rural areas enables the sustainability and expansion of rural businesses. The communities where ICT and e-Commerce projects are implemented need to be fully equipped with skills and resources (Jere *et al.*, 2009a). This thesis explains the implementation of a reward-based negotiation module for an e-Commerce platform for a rural community.

1.2 Project context

This research is done within the context of the Siyakhula Living Lab (SLL) project, which is undertaken in Dwesa (a rural community in the Eastern Cape Province of South Africa). The SLL project is an Information and Communication Technology for Development (ICT4D) project, initiated with the aim “to develop and field-test the prototype of a simple, cost-effective and robust integrated e-Commerce telecommunications platform for marginalized communities in South Africa” (Jere *et al.*, 2009b; Njenje, 2008; Tarwireyi *et al.*, 2007). There are many projects, currently running in this living lab. More details on the SLL projects are given in chapter two of this study. In this thesis, we have concentrated on improving the e-Commerce shopping portal already deployed for the Dwesa community. This was achieved through the development of a reward and negotiation application, which is an additional component to the existing e-Commerce platform.

Currently, an online shopping website has been developed for the Dwesa community. The website was developed in 2008 and is named *buy at Dwesa* and is available at www.dwesa.com. Various art and craft products are sold on this website. Since many people have access to *buy at Dwesa*, allowing for negotiations and the rewarding of customers is necessary to improve the customer services and attract other customers.

1.3 Problem statement

The majority of South Africa’s rural areas have no access to the basic infrastructure essential for economic growth and development (Wertlen, 2007). Many rural stakeholders suggest three major challenges that hinder small business expansion in rural areas. These are poor infrastructure, labour and capital (Kendall, 2001). Thus, the rest of the problems are centered on the three common challenges mentioned above. As far as labour is concerned the youth are leaving their rural homes in pursuit of employment opportunities in the cities (Summer Session Beyond Kyoto, 2000). This causes a loss of 3 to 5 percent of their population annually in rural communities and the out-migration of youth is decimating their future sustainability (Odasz,

2004). Rural entrepreneurs also face problems when selling products on the world market due to a shortage of resources, skills and innovative ideas to expand their markets (Jere *et al.*, 2009a; Kimball, 2006; Palmer *et al.*, 2002). The majority of rural people are poor, without enough capital and resources to effectively market their products (Dalvit *et al.*, 2007; Palmer *et al.*, 2002). Furthermore, technological illiteracy is another problem. This means that there is no support or maintenance readily available for ICTs. For example, only 2.3% of rural households in South Africa own or have access to a computer, and only 5.4% own or have access to a landline (Herselman, 2003). This is required for setting up the network for rural communities to access the Internet.

The problems above generally affect most of the rural entrepreneurs. However, in this thesis we have identified certain key problem areas. e-Commerce projects exist in rural areas, but these projects still fail to improve the livelihoods of the people they service due to low sales volume. For example, rural entrepreneurs in Dwesa have a website to upload and sell products, but they still face marketing problems. Thus, the implementation of a reward based negotiation module has helped to alleviate some of the identified problems.

Currently, *buy at Dwesa* does not allow customers to negotiate for discounts with the system while shopping online (Jere *et al.*, 2009c). Some customers may bring in new customers and increase the sales and reputation of the business, but get nothing for their efforts. All these problems are affecting business for the Dwesa community in their attempts to reach global markets, therefore this project attempt to provide one the solutions to alleviate the problems.

1.4 Aim and objectives of the project

The aim of the project is to implement a reward-based negotiating module which allows interaction with customers. It aims to motivate customers on *buy at Dwesa* by giving them points and rewards after buying online. The project adds value and brings an innovative idea to the current e-Commerce platform in Dwesa. It is meant to keep the existing customers and to attract many other customers by providing them with rewards for purchasing on *buy at Dwesa*. The aim is to “give top customers more and to let key customers know that they are valued”

(Hillary, 2006). This helps to build customer loyalty and thus increase sales revenue. We aim to achieve this by developing a system that accommodates the following:

All the rewards are based on points accrued, meaning each customer activity is given a certain number of points. Some of the factors which are going to be considered for points are user transaction history, the spending history, the customer purchase history, services history, customer responses to questions and any other information that enables identification of relevant rewards (Jere *et al.*, 2009b; JPMorgan Chase Bank, 2007).

Customers have the option of negotiating with the system for discounts and some rewards. A customer can make an offer on the given prices of the items added to their cart. The system automatically computes and checks on different factors to make a decision on whether the customer offer is acceptable or not. These factors are fully explained in chapter four of this thesis. Communication is between the system and the customer only. There is no third party or agent involved. The system sends feedback to the customer on whether the suggested or proposed discount is appropriate based on the factors that are activated in the database or else an alternative message is immediately communicated to the customer. Offers and counter-offers are made between the system and the customers, during the negotiation process.

Each customer is allowed various discounts or rewards based on the negotiation factors such as transaction history, number of hits on the site, the amount of money spent and the number of points accrued. All these factors should be active at the point of negotiation (Jere *et al.*, 2009b). Rewards are given according to the customer's participation on the system (Miller *et al.*, 2008). It is vital to note that the project in this thesis is an add-on to the current *buy at Dwesa*, thus modifications were done to accommodate the rewarding modules that are explained later in this thesis.

Some of the targeted customers include:

- customers having an interest in the traditional and cultural artifacts from the rural communities in the Eastern Cape
- Customers who may be encouraged to shop online by being rewarded

1.4.1 Specific system functionality

Having considered the problems listed in section 1.3, we have come up with a number of objectives. We expect the system to meet these functionalities after the improvements on *buy at Dwesa*. The objectives are as follows:

- Give points to customers on *buy at Dwesa*;
- Allow customers to make offers and counter-offers on the prices;
- Reward customers based on their customer details and order history;
- Calculate discounts based on the accumulated points and giving instant feedback to customers;
- Design interactive intelligent modules which are reliable.

1.4.2 Expected system benefits

After the development of the proposed solutions and having met all the above system functionality, we have also estimated the following benefits from the project.

- To attract more customers and keep the existing ones
- To develop a real time fast and efficient rewarding system
- To increase sales and maximize profits for Dwesa community shops
- To offer discount in a fair manner
- Effective Communication between the customer and the system

1.5 Motivation and contribution of research

As the e-Commerce platforms continue to proliferate and various shopping portals are developed, the provision of better customer services is critical. Online incentive marketing (for example, setting up loyalty programs on the site) is effective when it comes to building relationships with customers (Campanelli, 2001). Rewarding customers and allowing them to negotiate for better prices will increase sales and improve the reputation of the Dwesa shopping portal. This project has created unity amongst the community people, improved their computer knowledge as they are able to explore and find new features on the existing shopping portal.

The main contribution made by this project is to develop intelligent rewarding modules that allow customers to negotiate on the system and in turn allows the system to offer rewards to deserving customers. A unique feature of this research is that the system does the calculations and gives the customer feedback when buying online from a rural community. We are motivated by developing intelligent modules that make use of Artificial Intelligence (AI) applications to allow customers to negotiate online. There are no third parties or agents involved in decision-making. This enables the Dwesa shopping portal to create customer loyalty since it has been found that selling to existing customers is easier and cheaper than finding and selling to new ones (Hakala, 2008). Loyal customers tend to buy regularly and frequently recommend the business to others (Hakala, 2008). The project adds new features and has brought new interfaces to the existing *buy at Dwesa*.

1.6 Structure of this thesis

The rest of the thesis is structured as follows. Chapter 2 reviews literature relevant in the field of the development and implementation of a rewarding and negotiation module for an e-Commerce platform.

Chapter 3 provides a brief discussion of the system technologies and methodologies that were used in the design and implementation of the rewarding and negotiation system. It also explains the interaction between the customer and the system through UML diagrams. It also shows the system flow and explains all the activities that different entities play within the system.

Chapter 4 explains the negotiation module in detail. All the factors that were considered for the evaluation of the offers are explained in this chapter. The negotiation rules and the processes are given in this chapter.

Chapter 5 describes the development of the rewarding and negotiation system using the Linux, Apache, MySQL and PHP (LAMP) model. The chapter covers a basic description of the system and how the rewarding and negotiation modules were designed.

Chapter 6 describes the implementation of the system. It explains the PHP scripts and code written to come up with user-friendly interfaces.

Chapter 7 includes the testing and experimental results. This chapter evaluates the research project and shows some test results which were obtained from system testing. The chapter gives the feedback received from the system users.

Chapter 8 is the discussion and conclusion. This chapter gives an overview of what we achieved and the thesis summary. It also explains the ideas we have considered for future work to improve the shopping portal so as to attract more customers. Finally, it gives an overall conclusion for the entire thesis.

1.7 Conclusion

Problems facing rural entrepreneurs were identified. Thus, in this thesis we propose a rewarding and negotiation application aimed to increase the sales on *buy at Dwesa* and maintain customer loyalty. This allows the growth and survival of rural entrepreneurs in this dynamic world. Having identified several problems and the need to attract more customers to acquire products from the online Dwesa shopping portal, implementation of a reward-based negotiation module for online shoppers will be a critical solution.

CHAPTER 2: ICT4D AND E-COMMERCE PLATFORMS IN MARGINALIZED AREAS

This chapter reviews the ICT projects in marginalized areas of developing countries. It explains how ICTs enable rural development. It gives the trends of ICTs in rural areas of South Africa and highlights the benefits of e-Commerce in rural areas. The chapter explains the challenges faced by rural communities in trying to implement ICTs in their communities. The chapter describes how ICTs enhance e-Commerce in rural areas. A brief description of the research site, the Dwesa community,¹ is also covered in this chapter as well as the Siyakhula Living Lab.²

2.1 Introduction

ICTs assist the growth of Small, Medium and Micro Enterprises (SMMEs) in marginalized areas. ICTs enhance business transactions and, thus, improve e-Commerce platforms in marginalized areas. This chapter describes the ICT projects and e-Commerce platforms developed to explore rural development. It explains the relationship between ICTs and e-Commerce platforms. In addition to this, the chapter highlights the problems affecting rural areas when implementing ICTs and e-Commerce projects. However, several solutions are in place to ensure ICT sustainability in marginalized areas. Some of these solutions are covered in this chapter. The chapter focuses on giving some tangible highlights of ICT projects implemented in marginalized areas.

In addition to the chapter's explanation of the overall benefits of ICTs and e-Commerce, different ways of improving e-Commerce in rural areas are also elaborated on. These include e-marketing, customer loyalty programs through rewarding customers and online negotiation applications. However, this chapter concentrates on several ICT projects and e-Commerce projects that have been done in marginalized areas.

¹ Dwesa Community is the area where the project is going to be deployed.

² Siyakhula Living Lab (SLL) is the name used for all the ICT4D projects undertaken in Dwesa,

2.2 ICT for Development in marginalized areas

Information and Communication Technologies (ICTs) is a collective term referring to new and old technologies that facilitate the processing and transfer of information at a faster speed (COFISA, 2008). In a developmental context, older communication technologies such as newspapers, radio and TV offer considerable unrealized potential. The new technologies such as mobile phones and the Internet also have great potential to support the achievement of major development goals (Curtain, 2003; Sirigiridi, 2009). ICTs are believed to play a crucial role in poverty alleviation and strengthening positive social dynamics, hence they are viewed as enablers of community development (Department of Education and Department of Communication, 2001; Tarwireyi, 2008). Over the last decade, the Universal Service and Access Agency of South Africa (USAASA) and other organizations have been investigating ways of placing ICTs within the reach of all citizens (Parkinson, 2005). ICTs have to be supported and since most of them change with time, constant modifications and improvements can ensure growth of ICTs in marginalized areas.

Generally, ICT interventions need to be sustained culturally, socially, technically as well as economically and financially (Tarwireyi, 2008). People in rural areas need to be equipped with the knowledge of new ICTs and technologies. Aitkin (2002) says that, “Women are often the primary drivers of ICT development in their communities and in many cases make up the majority of the sellers of ICT services”. It is therefore, critical to ensure that women have full opportunity to gain equal access to ICTs, to learn how to use them effectively, and to share in the social and economic rewards ICTs can generate (Aitkin, 2002). Thus, ICTs can be seen as catalysts in rural development as ICT projects enable the rapid development of rural areas. It is generally accepted that rural development is a multidimensional concept aimed at achieving the following (COFISA, 2008):

- Poverty alleviation in rural areas;
- Developing local economies in rural areas;
- Achieving basic standards of health, safety and other developmental infrastructure and services in rural areas;
- Encouraging and enabling rural people to invest in themselves and their communities;

- Cultural regeneration, including the development and integration of indigenous knowledge systems into a rural community's ways of doing and learning;
- The long-term sustainability of livelihoods and improvements in quality of life.

In order to achieve rural development, ICTs have been deployed in these areas. The use of ICTs in significantly enhancing and supporting rural development is highlighted by the emerging importance of information and knowledge as key strategic resources for social and economic development (Pade, 2007). ICTs have continuously grown to enable e-Commerce projects in rural areas. The implementation of ICTs in developing countries requires a lot of resources. "The International Finance Corporation (IFC), a World Bank Institution has mobilized US\$5 billion in private capital over the past ten years in 100 different ICT related projects in developing countries" (Curtain, 2003). Thus, ICTs need commitment and support from different companies and organizations. ICT projects require many resources, from labour to capital and finance. ICTs have been widely deployed in developmental programs and this has led to the creation of a new field – ICT for Development (Wertlen, 2007).

2.2.1 ICT for Development (ICT4D) in South Africa

Considering the diversity in origins, cultures languages and beliefs within South Africa, ICTs in South Africa can offer a means of inclusion and integration (Louis Fourie Consultants, 2007). ICTs have the potential of transferring learning and an equally enabling environment within South Africa's dichotomous economy (Louis Fourie Consultants, 2007). The South African government is actively involved in ICT projects throughout the country (Louis Fourie Consultants, 2007). The government has identified different departments and encourages all stakeholders who are willing to implement and support ICTs. The government through several departments carries out different duties in bringing ICTs close to everyone in marginalized areas of South Africa. Below are some of the South African departments, involved in ICT and Development.

Table South African Departments in ICT
(Louis Fourie Consultants, 2007)

Government Department	Activities
The Department of Science and Technology	Conducts research and development
The Department of Trade and Industry	Assists trade and business development of ICTs
The Departments of Labour	ICT skill and capacity development
The Department of Communication and partly Department of Public Service Administration, and the Department of Public Enterprise	Oversees Telkom, South African Post Office, Sentech, South African Broadcasting Corporation, the National Electronic Media Institute of South Africa and the Independent Communications Authority of South Africa and Provides access points for ICTs in rural areas.

All these departments work closely with each other and aim to support the ICTs in South Africa and Africa as a whole to ensure rural development (Louis Fourie Consultants, 2007). According to the South African Cities Network, as of 2001, 42% of South Africans reside in rural areas (Statistics South Africa, 2006). This figure has encouraged the development of infrastructure and services in rural areas. As government holds significant ownership within the telecommunications industry, it has been able to mobilize access and expand affordable access to rural regions, which includes a nearly 50% increase in households with telephones from 1996 to 2001 (Louis Fourie Consultants, 2007). Therefore, people living in these communities need to have access to better services and thus deployment of ICTs in their areas is vital. The spread of ICTs in marginalized areas has attracted many developing countries all over the world. According to South Africa's ICT Development Framework, one of the goals for the Information and Communications Technology (ICT) sector in the country is to “increase [the] use of ICT as an enabler for socio-economic development, with equity”.

In this regard, “the intent is to specifically address equity issues with regard to gender, disadvantaged groups and those in rural and under-served communities” (Ungana Afrika, 2007). This means that ICTs play a major role in rural development and should get support from different stakeholders. Within the context of ICT4D, a number of e-services are developed and some of these include e-Commerce, e-Government, e-Health and e-Judiciary. Many other projects in ICT4D for marginalized areas have been deployed. Wertlen (2007) divided the ICT projects in rural areas of South Africa into different categories. The projects are categorized according to three stages, namely; completed project, partially completed and situated projects. Examples of ICT4D projects include:

- One laptop per child (Negroponte *et al.*, 2006)
- Digital Doorway (Kim, 2008)
- BingBee (Slay *et al.*, 2006).

All these projects are operating in different rural areas of South Africa. The projects are meant to improve the quality of life in marginalized areas of South Africa and fall under one of the categories listed above. However, this thesis focuses on only one project, which is almost similar to the examples listed in bullets. The details of the project are discussed in section 2.2.2:

2.2.2 Siyakhula Living Lab (SLL)

The name Siyakhula means “we are growing together”. The University of Fort Hare (UFH) and Rhodes University (RU) run it jointly, as both Universities are located in the Eastern Cape Province of South Africa. The mission of the Siyakhula Living Lab is to develop and field-test the prototype of a multi-functional, distributed community communication platform for deployment in marginalized and semi-marginalized communities in South Africa (Siyakhula Living Lab, 2008). SLL aims to develop the marginalized community by equipping people in the area with the necessary technological skills to support projects deployed. It shows how marginalized communities that are currently very difficult to reach may in future be joined with the greater South African and African communities to the economic, social and cultural benefit of all (Tarwireyi, 2008).

The Dwesa community is located on the Wild Coast of the former homeland of Transkei, in the Eastern Cape Province of South Africa. The community is under the Mbashe Municipality,

which belongs to the Amatole region based in East London. Willowvale is the nearest town, which is 50 km from Dwesa (Timmermans, 2004). The inhabitants at Dwesa are typically subsistence farmers who depend on the land for their livelihood (Palmer *et al.*, 2002). Most residents of Dwesa are also dependant on the state pensions of the elderly and other welfare payments. The Dwesa region features a coastal nature reserve which is an attraction particularly to South African tourists who, however, visit almost exclusively during school holidays. Although the nature reserve is a catalyst for tourism, government social welfare grants seem to be the main source of income for the local community. There are a number of activities ranging from basket-making to wood-carving.

Moreover, Transkei is rich in the traditional culture of the Xhosa people, and Dwesa has much to offer to tourists and to the outside world in terms of preservation of traditional customs and ceremonies, dances and, especially, music (Dalvit *et al.*, 2007). The area lacks basic infrastructure such as electricity in homes (schools and clinics were first electrified at the beginning of 2006), telecommunication facilities, running water and tarred roads, (TRALSO, 2006). There is a need to equip this rural community with an ICT infrastructure and deployment of the e-Commerce platform (Palmer *et al.*, 2002; Siyakhula project, 2007). There is a need to continue improving the existing e-Commerce platform, which is currently available, hence this project has chosen Dwesa as its research site.

In this regard, this thesis adds additional modules to the current system. According to Njenje *et al.* (2008), further developments and the changes to the existing system are encouraged as long as sustainability is ensured. In his e-Commerce project, which is also part of the SLL projects, Njenje (2008) encouraged continuous modifications to the existing system to fully benefit the rural community. There are many projects that have been developed for the Dwesa community. Some of them are already running and many are still in the developmental process. The e-Commerce projects include e-Shopping, e-Judiciary, e-Health, e-Government, e-Mobile, Help Desk and several e-Service projects that are currently underway. These projects are all under the name Siyakhula Living Lab. The projects are meant to develop the living standards of the Dwesa community.

The SLL project has attracted several organizations in South Africa and is sponsored by several organizations such as:

- Telkom Centre of Excellence (CoE) at the University of Fort Hare and Rhodes University,
- Technology and Human Resources for Industry Programme (THRIP) of the Department for Trade and Industry,
- Cooperation Framework on Innovation Systems between Finland and South (COFISA), a programme of the South African and Finnish governments,
- And a number of industry partners including, Telkom SA, Tellabs, Amatole Telecommunications, DRISA, Saab Grintek, and Mars Technologies.

There are many other stakeholders and organizations that are also playing important roles for the success of the SLL projects. The developments of such ICT projects like SLL have encouraged e-Commerce business in marginalized areas.

2.3 e-Commerce platforms in marginalized areas

e-Commerce platforms now exist in rural areas within most developing countries. This allows SMMEs in rural areas to increase sales and gain a market share on the global market (The Chamber of Commerce and Industry South Africa, 2005). e-Commerce involves the sale or purchase of goods and services over computer networks by businesses, individuals, governments or other organizations (Schneider, 2002). This can facilitate improvement in operations, leading to increased competitiveness and efficiency through the redesign of traditional business methods. This idea has improved e-Commerce projects implemented in rural areas. Most of the businesses in the e-Commerce platform are now implementing customer loyalty programs such as rewarding programs to ensure sustainability of e-Commerce platforms (Yue and Chaturvedi, 2000). The advantages of e-Commerce can be summarized by the statement that, “e-Commerce can increase sales and decrease costs” (Schneider, 2002). The e-Commerce projects in rural areas are aimed at generating income in these areas (Terzoli *et al.*, 2004). Ensuring sustainability of the ICT infrastructure deployed in these areas is crucial for e-Commerce development. Chhaya (2002) claims that “Despite the comfort that ICTs and e-Commerce has brought with itself,

humans are still involved in most of the important processes of business, for example, in making decisions in all phases of buying and selling”.

Therefore, there is a need to fully equip the community members in rural areas so that the actual benefits of e-Commerce are enjoyed (Jere *et al.*, 2009c). e-Commerce in marginalized areas still faces a lot of challenges, which are discussed later in this chapter. Small business in rural areas has benefited from e-Commerce, though it has resulted in a lot of competition when selling products. The growth of e-Commerce in rural communities has led to the development of many ways of selling products. e-Marketing is now the popular strategy and is spreading to rural communities. Customer loyalty programs are also emerging in rural communities to boost business. It is important to note, however, that there are many problems which are delaying the spread of e-Commerce to all the needed areas.

2.3.1 Selling in marginalized areas

Technological changes and rapid developments in e-Commerce solutions have led to the invention of new methods of selling products (Campanelli, 2001). A lot of methods and techniques are in place for selling products online. SMMEs are coming up with a variety of ways to market and sell products online. Some of the methods are going to be discussed in this section and these cover the most widely used methods in marginalized areas. Some of the marketing techniques and methods commonly used are advertising through the radio, television and the printed media. Posters, online presentations and other traditional methods can also be used to sell or exchange goods and products.

The Internet is seen as the fastest and most efficient way of doing online shopping. It is noteworthy that, “the Internet has successfully generated an ever-expanding cohort of users for all its different functions, including information gathering, communications and transactions” (Shiu *et al.*, 2004). In order to maximize online sales, several strategies have to be implemented. Some of these strategies include, identifying best customers, dividing and reward, and staying up to speed (Krotz, 2003). To be able to utilize these strategies, there is a need to effectively communicate with the customers. Some of the strategies to communicate with customers are to:

- Send personalized thank-you notes to customers,
- Send reminders to customers,
- Send e-mail offers,
- Send holiday or personal offers,
- Offer steep discounts at off-peak times.

These steps are important for the success of on-line shopping portals deployed in marginalized areas of South Africa. These enable direct communication with customers and create good relationships with customers. Constant communication with the customers increases sales and the reputation of rural entrepreneurs as it keeps customers close to the business (Jere *et al.*, 2009).

On-line shopping is reported to be rapidly growing and providing discounts, rewards and good customer care are key factors (Centeghe, 2006; Hakala, 2008). This indicates that shopping online continues to gain more popularity almost every day in all continents including Africa. As indicated by Dandjinou (2000) who says that “while Internet access is now widespread in Africa. Dandjinou (2000) claims that “all countries except Somalia and Eritrea are connected, the number of African Internet users is somewhere between 1.5 to 2 million out of a continental population of 750 million, and most of these (at least 1.5million) are residents in South Africa”.

This certainly means that in South Africa the growth of the Internet is fast, hence the reason why it is available in many rural areas. Knight (2008) says, “The Internet is responsible for changing the way most people do business now”. Having Internet accessibility in rural areas enables the implementation of e-Commerce projects. In trying to offer the best online selling services, Artificial Intelligence applications and expert systems have been developed. Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can engage in behaviors that humans consider intelligent (Simon, 1997). The ability to create intelligent machines has intrigued humans since ancient times and today with the advent of the computer and 50 years of research into AI programming techniques, the dream of smart machines is becoming a reality (Simon, 1997). Researchers are creating systems, which can mimic human thought, understand speech, beat the best human Chess player, and countless other feats never

before possible (Simon, 1997). The rewarding modules explained in this thesis are part of the AI applications. However, these applications face difficulties in supporting e-Commerce.

2.3.2 Challenges affecting e-Commerce platforms

According to Van Aardt et al (2008), 23.7% of new businesses in South Africa are dissolved after about two years of establishment, while 51,7% are dissolved after 4 years. The development of e-Commerce projects has created a lot of competition for businesses to sell products (Schneider, 2002). The pressure is greater for businesses in rural areas. The problem is that the majority of the population in rural areas lacks adequate knowledge to fully support their systems (Van Aardt *et al.*, 2008). SMMEs still face problems in marketing their products on the global market. Doing business online is not enough for SMMEs to penetrate global markets hence, there is a need to discover new selling strategies.

According to Khosla (2008), “SMMEs cannot do conventional marketing because of the limitations of resources”. The infrastructure in rural areas is very poor and as a result, communication in these areas is very difficult. Network problems and inaccessibility of Internet in rural areas is part of the problem (Dalvit et al, 2007; Palmer *et al.*, 2002). Most of the businesses in rural areas are too small and lack enough capital to offer rewards to improve customer loyalty (Jere *et al.*, 2009a). These areas rely on donations and funding, so may find it difficult to have extra products to offer as rewards (Palmer *et al.*, 2002).

Internet infrastructure alone has proven to be inadequate to sustain rural communities. The effective use of infrastructure is essential to creating a meaningful info-structure built on concrete content and effective collaborative practices. “Social engineering strategies engaging citizens in ongoing self-directed online learning are needed to enable rural citizens to determine their own destinies and together build a sustainable future” (Odasz, 2004).

Many of South Africa’s rural areas are still poor and lack the basic requirements because they have no access to basic infrastructure essential for economic growth and development (Wertlen, 2007). The majority of rural people are poor people without enough capital and resources to fully and effectively market their products (Dalvit *et al.*, 2007; Palmer *et al.*, 2002). SMMEs face problems when selling products to the entire world due to the shortage of resources, skills and

innovative ideas to expand markets (Kimball, 2006). This is because of high levels of illiteracy in these areas leading to ICT project failure.

Again, sustainability is another problem in rural areas. The main challenges with regard to maintaining the sustainability of e-Commerce platforms are:

- High implementation costs.
- Limited usage – not enough to sustain
- Need to encourage private sector participation
- Need for effective management
- Need for strong community support
- Need for ICT training – wide coverage
- Technology moves fast

Hence, most of these projects fail and do not benefit the targeted communities. According to the United Nations Report (1997), “more than 850 million people in developing countries are excluded from a wide range of information and knowledge, with the rural poor in particular remaining isolated from both traditional media and new information and communication technologies which would improve their livelihoods”. It remains a big challenge to develop these areas and implement sustainable projects. A lot of barriers are available in rural areas leading to unsuccessful ICTs and e-Commerce projects. Considering the problems above, small businesses in rural areas are therefore, affected and thus face challenges in selling products to the entire world. Considering the fact that approximately 66% of all poor people in South Africa live in rural areas as said by Statistics South Africa (1999), it means that these people may fail to raise capital and any additional expenses required for the growth of e-Commerce projects in their areas. The problems above indicate that doing business in rural areas is very difficult and requires a lot of capital and resources to be able to sell products on the global market. However, in Dwesa most of the common problems stated have already being attended to and this will see the proposed rewarding application improving the shopping portal services and attract more customers.

2.3.3 Improving e-Commerce projects

Having highlighted the problems affecting e-Commerce growth in rural areas, it is also necessary to give some solutions that are in place to resolve the problems. e-Commerce platforms face a lot of challenges that can lead to collapse of the projects. However, there are different ways and strategies in place to ensure sustainability of these systems in rural areas. SMMEs in rural areas are implementing some marketing strategies that are important for the survival of e-Commerce projects in rural areas. Some of the services that are currently implemented in rural areas include:

- e-Marketing services
- improved online selling techniques
- Customer loyalty programs

2.3.4 Customer loyalty programs through rewarding applications

For small businesses, in e-Commerce business, keeping customers is a way to help them to compete and survive in markets with large businesses (Campanelli, 2001). To be able to attract customers various strategies have been implemented. However, this thesis concentrates on reward based applications as a strategy. Reward based programs are meant to market the products already on the websites. Such programs motivate customers and allow them to shop again (D'Agostino, 2005). There are several e-Commerce platforms which offer rewards (Hammond, 2006; Krotz, 2003). Consumers today are bombarded with offers, information and discounts (Katz, 1999). Most of the businesses in the e-Commerce platform are now implementing rewarding programs so as to be able to create customer loyalty (Hakala, 2008; Yue and Chaturvedi, 2000).

Rewarding programs are based on points. There are many rewards and incentives that can be offered by businesses and these, differ from one business to the other depending on the nature of the business (JPMorgan, 2007; Krotz, 2003). Many factors have to be considered for a rural reward program to be implemented and benefit the community. Thus, the rewarding application hinges on the premise that it is cheaper to keep a customer than to attract a new one (Young, 2007). Indeed reward systems are designed on the assumption that the only thing that motivates one is money. Of course, money is important but, according to Herzberg's (1957) two-factor model of motivation, money can also create dissatisfaction. There are many other non-financial

motivators that can be explained (Armstrong, 1993). Therefore, a variety of products could be available and offered as rewards. The rewarding application thus aims to allow the growth of business in a rural community. Again, it is a great way of creating customer loyalty (Hakala, 2008). Negotiation and a Rewards system for customers buying online is an innovative way of expanding small business.

2.3.5 e-Marketing in Marginalized Areas

The growth of e-Commerce in rural communities has led to development of many ways of selling products. e-Marketing is increasing and is slowly becoming a popular strategy. Highposition.net defines Internet marketing, also referred to as online marketing, e-Marketing and web marketing, as essentially the practice of communicating products and services to consumers over the Internet. “SMEs need to search for alternative marketing approaches such as personal contact networks, social networks, e-Commerce tools, Business to Business (B2B) portals, business networks and industry and marketing networks”, (Bikky, 2008).

However, developed countries and large organizations stand a greater advantage in the field of web marketing. For example, Highposition.net noted that, “there are 41.8 million Internet users in the United Kingdom which equates to 68.6% of the UK's population”. This is a 171.5% rise in the period 2000-2008, which is continuing to rise. Highposition.net (2008) continues, “globally there are 1.464 billion Internet users which equates to 21.9% of the world's population. With such, vast numbers of consumers, e-Marketing is creeping up on television as the most popular and effective marketing medium (Highposition.net, 2008). For rural communities in developing countries to be able to penetrate the global markets, selling products effectively through the use of e-Marketing is proposed.

“New rural community leadership models are urgently needed for rapid identification of the unprecedented new opportunities, which the Internet offers such as new global markets, e-Commerce and unlimited online learning resources for alert citizens” (Odasz, 2004). Therefore, SMMEs in marginalized areas need to utilize the advantages of the Internet and come up with better marketing strategies. “The lifeblood of a business is marketing to create a continual stream

of new customers, to build the business and maintain the flow of existing customers coming back” (Barbara et al., 2006).

e-Marketing programs need to be well planned and allocated enough resources. There is a need to properly organize and identify the best strategies to implement and benefit from e-Marketing. This thesis discusses some of the e-Marketing strategies which have been implemented by some organizations to gain market share. These include:

2.3.5.1 Allocating points

This marketing strategy is now popular and spreading all over the world. Most business organizations are implementing it. It allows businesses to identify their best customers. Customers get a specific number of points for all the activities which they perform online. According to The Dashboard's Incentive & Loyalty Points Management system (2008), the application allows the creation of points-based incentives, promotions and a loyalty system to reward visitors, customers and members for purchases, promoting the site, engaging in feedback, taking tests, and much more. The products have a certain number of points assigned and for each activity performed a customer will receive points. The main activities that may be carried out are registration, buying online, making positive suggestions about the business and referring friends. Customer points are used for negotiation with the system to evaluate the offers.

2.3.5.2 Negotiation Online

Negotiation, which involves a lot of decision-making and tradeoffs between various factors, is one of the key components of e-Commerce systems. According to Chhaya, (2002) most business transactions in e-Commerce involve negotiation to settle on the most suitable price for both parties. However, negotiation is not common in standard e-Business site like Amazon. Thus, as a way of improving the services of e-Marketing, allowing customers to negotiate for discounts and better offers when buying online create a better customer care. Negotiation aims to create a dialogue between the business and the customers.

In e-Commerce systems, where negotiation online is implemented, the customers' power to negotiate is based on the number of points available (Jere *et al.*, 2009b). Through negotiating,

customers increase their chances of getting rewards. As noted by MoneyhighStreet Staff, (2007) one of the best ways of saving money when buying an expensive item or service is through negotiation with the supplier. By taking the trouble to negotiate, one can save large amounts of money, with very little effort. However, in most of the businesses, customers will not be saving money necessarily, but will be negotiating to get a reward rather than to pay less. There are different incentives that customers may be negotiating for.

2.3.5.3 Rewarding and redemption

The best way to reward for the first time is rewarding for quantity rather than quality. Thus, a small reward such as a chocolate, a piece of fruit or a pen for every idea can be effective, according to Del and Mass (2007). Allowing customers to redeem points for rewards adds value to e-Marketing and improves e-Commerce business in marginalized business.

According to Point Patrol (2006), a list of all the rewards available should be displayed along with the corresponding points and a check box to redeem each award. When a checkbox is selected, the points required are subtracted from the user's points. If the user does not have enough points, a message should be displayed informing the user of how many more points they need. The number of points redeemed and the incentive to be received should be displayed to the customer. e-Marketing, if offering the services mentioned above, attracts many customers when selling products online.

2.3.6 Technologies and securing e-Commerce systems

The increase in online transactions has been accompanied by a rise in the number of different attacks that affect the security of online payment systems (Steve, 2006). Some of these attacks have utilized vulnerabilities that have been published in reusable third-party components utilized by websites, such as shopping cart software (Jeremy, 2006). Other attacks have used vulnerabilities that are common in any web application, such as SQL injection or cross-site scripting. Several technologies are available for designing, managing and developing e-Commerce platforms like the one for the Dwesa community. When business outgrows the functionalities that a simple static website can offer, there is a need to implement a more complex dynamic website that is capable of interacting with clients or viewers (PHP group,

2007). There is a need for a simple online store, product catalog system, or a secure shopping cart system with Secure Socket Layer (SSL) technology, password protected areas and advanced search facilities, as stated by Innovative Web Solutions (2008). Such standards are to be considered on the *buy at Dwesa* website.

Many of the custom designed e-business solutions and applications are developed by using the famous combination of Linux-Apache-MySQL-PHP (LAMP), which is one of the most widely used and popular open source combinations (Open Source Initiative, 2007). This is also the one chosen for the implementation of the reward based negotiation module for an e-Commerce platform in Dwesa.

PHP is widely used for developing a dynamic, database-driven website. For an e-Commerce system, e-business application, collaborative networking systems, content management system or back-end system for data management, PHP is the website application most commonly used (PHP Statistics, 2007). This language has been chosen for this project. For online payments PayPal, which is owned by eBay, is used in most rural areas in South Africa (PayPal, 2008). It is probably the best-known credit card alternative (eBay, 2008 & PayPal, 2008). The main reason for PayPal is that it makes use of Post Offices, which are available in many rural areas. The exact technologies used in the Dwesa shopping portal under discussion in this thesis are explained in chapter three.

2.4 Relevant case studies

The case studies below, considered for this thesis, have implemented a rewards program that makes use of points as a strategy to attract customers. Some of the case studies allow negotiation online. Some of these examples are described below.

2.4.1 ABSA Rewards

Abisa Rewards is a rewards program created to acknowledge and reward Absa bank's valued customers for their continued support and loyalty (Abisa, 2009). The program is available to

existing and new Absa customers. These customers have to register online to benefit from the system.

Earning Absa Rewards Points is easy. Once one has registered for the Absa Rewards program, you will receive a welcoming bonus of 500 Absa Rewards Points and from there one starts earning Absa Rewards Points for holding qualifying Absa banking products and spending on the Absa Rewards credit card (Absa, 2009).

Absa Rewards offers more than 1500 different rewards available from the Absa Rewards Catalogue. Absa Rewards ranges from top quality merchandise, to air tickets and even weekends away (Absa, 2009). Absa Rewards Points do not expire. They continue to accumulate until one chooses to spend them or transfer them to other Absa Reward members.

2.4.2 Best Buy Rewards Program

The Best Buy Rewards program was launched as a way to reward frequent customers for their purchases. Members sign up and receive a membership card which has a unique number for storing points and recording transactions. The membership card is not a credit card, but rather a points system through which shoppers can earn gift certificates for certain purchase amounts. For every dollar spent at Best Buy or at BestBuy.com, you earn 100 reward points toward free merchandise (Best Buy Rewards, 2009). When you acquire enough points, you can redeem them for any product you choose in the store, which means free merchandise. The Reward Zone program is also unique because it does not take thousands of dollars in purchases to earn rewards. The points system is as follows:

Table Best Buy Rewards
(Best Buy Rewards, 2009)

PURCHASE	POINTS	REWARD CERTIFICATE
\$150.00	15,000	\$5.00
\$350.00	35,000	\$10.00
\$750.00	75,000	\$25.00
\$1,200.00	120,000	\$40.00

2.4.3 ProductCart's Reward Points

ProductCart's "Reward Points" extension allows merchants to promote customer loyalty and increase sales by rewarding customers for purchases and for referring other customers (ProductCart Rewards Program, 2009). It can be added to an online store powered by ProductCart v1.6 and above, at any time, without disrupting the store's functionality. It contains tools that allow the store administrator to quickly configure and implement its new features. The system allows store administrators to implement a marketing program that mimics the airline industry's popular 'miles' program (ProductCart Rewards Program, 2009). Customers earn points while making purchases or referring other customers, then they are able to redeem points for discounts and free merchandise.

Among Reward Points' unique features (ProductCart Rewards Program, 2009) are;

- "Points, miles, golden nuggets. The merchant has full control on how the rewards program is implemented, starting with its name. Through an intuitive interface fully integrated with ProductCart's point and click Control Panel, the store administrator can assign a name to the program, which will be reflected anywhere across the on-line store.
- "Earning Points. The merchant can easily assign points to products. The store automatically displays how many points each product will earn a customer, and shows a summary of total points for the order before and after the order is submitted. Customers can log into their account and view a summary of earned and used points at any given time.
- "Redeeming Points. The merchant sets a conversion rate between points and dollars. A 20% conversion rate would mean that customers can redeem 100 earned points by deducting \$20 from their next purchase on the store.
- "Promoting Word of Mouth. Merchants can also allow existing customers to earn points when they refer other customers that make a purchase on the store. The amount of points earned on a referral can be a fixed amount or based on the new customer's order value" (ProductCart Rewards Program, 2009).

It is critical to note that many of the ideas used in the implementation of this thesis were borrowed from the ProductCart Rewards program.

2.4.4 O-Cham Reward Program

O-Cha.com has a customer loyalty point system for their regular, registered customers. Registered customers earn one point for every US\$1 (O-cham, 2009) of purchases made, excluding shipping charges. These points may be used in full or in part to pay for future orders. O-cham believes in this program as a way of rewarding loyal customers. While one does not have to register to order items from O-Cha.com, one needs to register and use the same login information each time a purchase is done to earn bonus points (O-cham, 2009). It differs from the idea for the Dwesa Rewards program in that the Dwesa points are not used to pay for orders, but only as a negotiation tool, to negotiate for discount.

According to O-cham (2009) points are obtained as follows:

- “All customers who make a purchase from O-Cha.com are eligible to receive points. The system is automatic, however, and you must be registered and are logged on prior to making the order to receive the points.
- “Points earned may be applied to future orders only.
- “Nearly all of the items receive points, but there may be a few already discounted items or specials that do not have the points
- “Refer a friend to O-Cha.com and receive 1/2 of their first purchase in customer loyalty points!”

2.4.5 Vodacom Rewards program

Rewards for loyal Vodacom customers are issued by Vodacom: “Vodacom, South Africa's leading cellular network, is rewarding its loyal prepaid customers by introducing Vodacom Talking Points, a loyalty awards system wherein recharge points can be accumulated to exchange for call discounts, SMS bundles and free cell phones”.

Vodacom released a statement soon after implementing the rewards program, saying that Vodacom's South African customer base comprised of more than 15.8 million prepaid customers, reflecting an increase of 12.2% since 30 September 2005 (Vodacom customer Rewards Program, 2009). This growth rate was made possible by the prepaid customers' loyalty and with Vodacom Talking Points. “We are saying thank you to all these customers”, says Shameel Joosub the Managing Director of Vodacom South Africa.

Every time customers recharge with Vodacom's prepaid recharge vouchers, they earn Vodacom Talking Points. Customers have been earning Vodacom Talking Points since 1 November 2005 and can find out how many Vodacom Talking Points they've earned by calling 082 2411 082 (free from a Vodacom cellphone) or by registering online at www.vodacom.co.za. Customers started to exchange Vodacom Talking Point for rewards on the 5 March 2006.

Vodacom Talking Points can accumulate for a period of 18 months in monthly buckets similar to Free Bundled Minutes (Vodacom customer Rewards Program, 2009). Any Talking Points that are older than 18 months and that have not been exchanged for free rewards will be forfeited. “To become a Vodacom prepaid customer, customers can buy any one of the Vodacom prepaid starter packs at various participating outlets and start recharging as soon as possible,” Joosub says. Every time you recharge, Vodacom will notify you of how many points you have earned.

2.4.6 Aroxo Negotiation Application

At Aroxo, customers have to find the product they're looking for to buy and say what they'll pay for it (Aroxo, 2009). On Aroxo there is no right or wrong price. To help customers to set their prices at the right level there is a thermometer that helps to discover what prices are most likely to work in the Aroxo marketplace.



Figure Aroxo Thermometer

Figure shows the Aroxo thermometer that allows the customer to know how to make an offer, as it is a good communication tool between the system and the customers. When you tell Aroxo

how much you'll pay for an item they create a Want-it Note (Aroxo, 2009). This is like a little advert, which tells Aroxo sellers what you want, and how much you want to pay for it.

Figure 2 is displayed to a customer buying on Aroxo. (This is the good bit!) What do you do when you're in a shop, buying something face to face? You negotiate of course. (Aroxo, 2009). Well, now you can do exactly the same thing on Aroxo.



Figure Making a Negotiation Decision

Figure , above, shows the different options a customer has when buying online on Aroxo. Customers can accept the given price, negotiate or reject the offers. Once you've received an offer from a seller you can buy the product straight away by clicking the Accept button (Aroxo, 2009). Alternatively, you can negotiate with the seller. Negotiating on Aroxo is simple and fast and it might just grab the customer an unbelievable deal (Aroxo, 2009).

Once it's all done and you've received the item, all that's left is to leave feedback for the seller and they'll leave feedback for you (Aroxo, 2009). In summary, Aroxo allows customers to make offers on any items that they want to buy (Aroxo, 2009).. We have used the ideas on Aroxo for the development of the negotiation module and the implementation chapter explains how this idea was implemented.

2.5 Analysis of case studies

Of course, many of the case studies discussed above are certainly applicable to this project. However, many of them seem to be implemented by large organizations and are mainly found in developed countries. Aroxo's negotiation technique was considered for implementation of the rewarding interfaces dealt with in this dissertation. It is appreciated that the project is for a small organization and for a rural community in a developing country, but it has to borrow some ideas from all types of businesses in order to add value and implement an innovative solution for the Dwesa community. The following are the features of the Dwesa Reward Program (DRP) as derived from the discussed case studies:

- Customer Reward Points are not transferable.
- Customer Reward Points cannot be redeemed for cash.
- Customer Reward Points can be redeemed only while shopping with us online.
- Customer Reward Points are calculated on the purchase price of the product, excluding discounts, taxes, shipping, handling, and insurance costs.
- Some selected products will not earn you Customer Reward Points. Likewise, you may not redeem points when purchasing such products.
- Customer Reward Points not used after some months will be forfeited.
- Customer Reward Points are automatically credited once an order is processed.
- Customers can make offers and counter-offers on prices.

2.6 Conclusion

ICTs have expanded to most rural areas in developing nations. This has resulted in the creation of shopping portals allowing the development of e-Commerce solutions in marginalized areas. However, ICTs and e-Commerce projects face challenges and hence fail to benefit the targeted communities. Different stakeholders are trying to improve ICTs in rural areas to raise the livelihoods of people in these areas. e-Commerce platforms are being improved with better services such as e-Marketing, customer loyalty programs and on-line shopping portals. There is more work that is still to be done to ensure that e-Commerce solutions in rural areas improve the growth of SMMEs in these areas.

This thesis explains a customer loyalty program based on points. It is a rewarding application aimed at giving back to the customers who are willing to buy on the Dwesa shopping portal. The rewarding application incorporates some of the characteristics that are explained in the case studies. e-Commerce platforms need to be supported and implementing customer loyalty programs such as the one suggested is going to sustain these platforms and benefit rural areas. The next chapter covers the methodologies and the technologies we used to develop the rewarding modules.

CHAPTER 3: DWESA REWARDING MODULES

This chapter gives an overview of the modules that make up the rewarding application. It explains the methods and technologies used for allocating points, negotiation and rewarding customers on buy at Dwesa. A description of the main roles of the entities of the system covering the front-end and back-end analysis are to be discussed in this chapter.

3.1 Introduction

The existing *buy at Dwesa* deployed for the Dwesa community made use of different technologies. We have also discovered that there are several methods and technologies that are available for the development of shopping portals. However, in this thesis we have focused on the technologies used for *buy at Dwesa*. The chapter gives a full analysis of how points are allocated, how customers negotiate with the system and how rewards are calculated. The application explained in this thesis is referred to as the Dwesa Rewarding Program (DRP).

3.2 *buy at Dwesa* methodologies and technologies

Many of the custom-designed e-business solutions and applications are developed using the famous combination of LAMP (PHP Group, 2007). This is one of the widely popular open source combinations (Open Source Initiative, 2007). *buy at Dwesa* is currently running on this platform. This is the one chosen for the implementation of a reward based negotiation module for an e-Commerce platform in Dwesa. The system requires critical content management with enhanced security features. When a business outgrows the functionalities that a simple static website can offer, there is a need to implement a more complex dynamic website that is capable of interacting with clients or viewers (PHP Group, 2007). There is a need for a simple online store, product catalog system, or a secure shopping cart system with Secure Socket Layer (SSL) technology, password protected areas and advanced search facilities (Innovative Web Solutions, 2008). Such standards have been considered for the development of *buy at Dwesa* and for the development of the rewarding application.

PHP is widely used for developing a dynamic, database-driven website. For an e-Commerce system, e-business application, collaborative networking systems, content management system or back-end system for data management, PHP is the most popular programming application, which is used (PHP Statistics, 2007). The use of PHP market share in South Africa is still growing at an average 40% per annum (PHP Statistics, 2007). This programming language has also been chosen for this project. The technologies above were used for the development of *buy at Dwesa*. The screenshot below (Figure 3) shows the homepage of *buy at Dwesa*. The development of the rewarding modules was designed around this application.

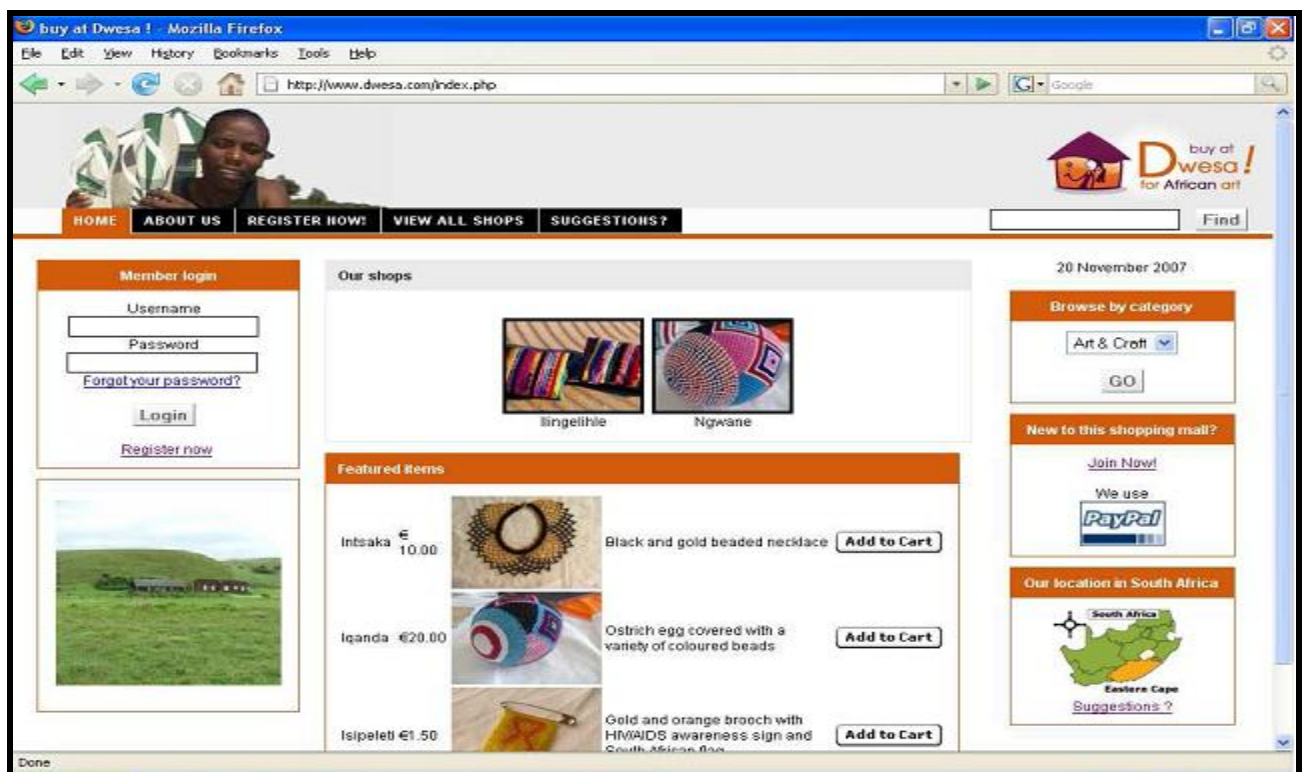


Figure *buy at Dwesa* Main page
(Njenje, 2008)

buy at Dwesa contains information about all the shops that are available to the online buyer and all the products on sale in the shops. It also allows customers to register online, login, buy items, make suggestions and it carries information on all participating rural entrepreneur groups. The system provides three user interfaces, namely;

- The seller's interface (for shop managers to manage their shops and upload items),

- The administrative interface (for the administrator to access and manage the shopping portal system),
- The customer's interface (to buy the products on display).

The front-end is also accessible to the shop owners and the system administrators to monitor the changes that have been made from the back-end. The interface displays the information on the product status, the number of points obtained and the total value of the order. All these details are visible to anyone logging on to the site. To develop the front-end interface, several technologies have to be used and combined to produce a standardized interface. However, it is also important to consider the fact that this rewarding application resides on the current Dwesa shopping portal. Thus, there is a need to consider technologies which were used for the development of *buy at Dwesa*. This is to maintain system integrity. Of course, some new technologies and methods were considered for the development of the DRP. The technologies that were used for *buy at Dwesa* include:

- **Hyper Text Markup Language (HTML)**

Hyper Text Markup Language (HTML) is a simple mark-up language that designates how the web pages look in the browser, but they will simply be text (Michele and Phillips, 2007). HTML is the standard language used to create web pages. It uses tags to display the pages, with each tag having a particular function which each browser understands and interprets. Each tag has an opening and a corresponding closing tag. Each type of browser uses its own set of rules to interpret the HTML and render the page. As each browser uses its rules to interpret the HTML, the same page might appear different when viewed on different browsers.

- **Cascading Style Sheets (CSS)**

Cascading Style Sheets (CSS) can do three things (Livingston and Brown, 2002)

- Set the font of text on a page and color of the text;
- Define a layer and position the text on the page;
- Modify HTML tags.

CSS allows the developer to place the chunks of content, such as images, text, tables and forms with pixel perfect exactness (Livingston and Brown, 2002). CSS also allows *padding*. This refers to the space that occurs between the edge of an element and the beginning of its border. CSS is added to PHP and HTML to allow the control of the web page layout. For the Dwesa Rewarding Program, the style sheet defines how certain elements such as frames, page contents and links appear.

- **JavaScript**

JavaScript is used for a client side processing. When a user requests a page, a copy of the HTML file is sent from the web server to the computer of the person who has made the request (Craig, 2001). JavaScript is contained in HTML code. JavaScript code is written and embedded with-in tags in a PHP or HTML document. JavaScript is used to create different layers of the project. It allows the visibility and disappearing of layers, it displays a new layer when the user clicks on a new navigation and hides the previous page (Livingston and Brown, 2002). Therefore, on the rewarding application JavaScript allows the users to be redirected to the web browser. It is also used to send feed -back between the system and the customers during negotiation.

- **Dynamic Hyper Text Markup Language (DHTML)**

Dynamic Hyper Text Markup Language (DHTML) involves the use of Java scripts to manipulate styles sheets, for example to hide, display, or move layers or to change the font of some text as a user rolls a mouse over it (Livingston and Brown 2002). DHTML is used to make layers appear and disappear and for simple animation. DHTML creates sliding pop-up menus, draggable images and interactive quizzes. DHTML is often just the combined use of Style Sheets and JavaScript. An example of the functionality provided by DHTML using the style sheet was to show an image of an item when the mouse was placed on the item name.

3.2.1 System back-end technologies

The back-end interface is where all the functions and services that are visible to the front-end are developed. The system administrators have access to the back-end interface and make all the necessary developments in and modifications required of the rewarding application. Operations that are done from the back-end include the management and administration of the database,

users, shops and items (Njenje, 2008). The system administrator is responsible for creating, deleting, and updating shops and provides the shop-owners' credentials for login from the front-end (Dyakalashé, 2008). As the system uses PHP scripts, it uses a script-interpreted service program to execute requests from clients and construct a response. Part of the back-end is the MySQL Database (DB). PHP does not store information by itself. Therefore, MySQL which acts as the filing clerk for PHP-Processed user information is chosen (Michele and Phillips, 2007). phpMyAdmin was chosen to directly access and manage MySQL Database. phpMyAdmin is Open Source software written in PHP and it is published under the GNU General Public License and is available for free download (phpMyAdmin, 2007). phpMyAdmin makes the management and administration of the database easier as it uses a GNU. The following back-end technologies we considered include:

- **Linux Platform**

The current multipurpose shopping portal platform deployed as part of the on-going Siyakhula Living Lab projects use Ubuntu Linux as its operating system. We aim to develop a system that can run on the current Ubuntu Linux platform. Hence, DRP is also running on open source software, which is open to all improvements and future versions. Ubuntu Linux was chosen to make the project cost-effective and self-reliant. The Ubuntu Linux operating system is very secure when compared to other operating systems (Solarbluseth, 2008). Thus, it creates a secure environment for running the web servers with our rewarding system. There are very few viruses for the Linux operating system and it thus requires far less virus protection software than that which is required on the Windows platform (Solarbluseth, 2008)

- **Apache Web Server**

The Apache web server turns browser requests into resulting web pages and knows how to process PHP code (Michele and Phillips, 2007). Therefore, since PHP is only a programming language, it needs the power of a web server like Apache. This allows users to access pages with PHP language code which is used extensively in the world of information systems (PHP statistics, 2007). The Netcraft web server survey explains that Apache has been the most popular web server on the internet since April 1996 (Michele and Phillips, 2007). For the development of DRP, we chose Apache Web Server 2.0 software because it provides open-source licenses for us

to access the source, in addition to the right to use and modify and, most importantly, the right to distribute.

The open-source web server, Apache, provides a high level of security, higher security than that of proprietary software products such as Microsoft IIS (Michele and Phillips, 2007). Apache 2.0 is a major rewrite (which means that if there is any feature that you want but does not exist in Apache, you can write your own server module) and it supports threading (Weinstein, 2004). Threads allow a single process to manage more than one thing at a time. This increases data processing speed and reduces the resources needed (Michele and Phillips, 2007). One of the great advantages of the Apache web server is its modular architecture. In Apache Web Server, you can add or remove functionality as dictated by the system's requirements. Apache is also extensible, because both the Apache server and API source code are open to the public (Kamthan, 1999).

The administration of an Apache web server is very convenient because one can control the server remotely from the command line. The Apache server is very compatible as it can run on many operating systems other than Windows (Weinstein, 2004). Thus, considering the above advantages and the features available in the Apache server, it is preferred for the development of DRP.

- **MySQL Database Server**

MySQL database server is a free full-featured relational database (Michele and Phillips, 2007). MySQL supports several different database engines. These database engines determine how MySQL organises the actual storage and querying of data. The server is best suited to use on systems that are designed to be portable and reliable. The server has an active development team for user support and constantly gains added capabilities that are always available as open source software (Michele and Phillips, 2007). MySQL's current release is MySQL 5.1.3 and this is the version used for Dwesa Reward Program modules. The rewarding system uses a set of features that come with the MySQL Database. These include triggers, event schedules and stored procedures. The benefits that MySQL has, in its ability to secure data, easy connections and localization, were also considered. All these advantages explain the reasons for choosing MySQL for the DRP development.

Furthermore, what needs greater consideration for the back-end technologies are the different protocols used to communicate with different individuals who use the Dwesa Rewarding Program. Some of the protocols that are considered for this thesis are:

- Hypertext Transfer Protocol (HTTP) – to transfer web pages between the users and the rewarding application.
- File Transfer Protocol (FTP) – this tool is utilized to transfer files from one server to another server.
- TELNET – this is for remote login.
- MAILTO – for sending e-mails.

3.3 Analysis of the rewarding modules

From the interviews and surveys conducted, the results indicate that the shop owners prefer customers who buy products in bulk. There were also indications that the additional modules discussed in this research are going to attract more customers and maintain the existing ones. The interviews also indicate that there are high chances of growth in the shops as production is likely to increase. The shop owners also expect to grow in terms of the number of people involved, as sales are likely to increase. Giving customers points was viewed as one of the ways of keeping the existing customers, whilst negotiating using points was seen as a means to be close to customers or to understand more about customer needs, giving them rewards as a way to attract new customers. The DRP modules include points allocation, negotiation and the rewarding module.

3.3.1 Points allocation module

DRP relies on points that customers get from registration, referring friends and buying online amongst several other activities. Customers get a specific number of points and there are some minimum points, which customers should have accumulated before they can negotiate for rewards. According to The Dashboard's Incentive & Loyalty Points Management system (2008), the system allows the creation of points-based incentives, promotions and a loyalty system to reward visitors, customers and members for purchases, promoting the site, engaging in feedback,

taking tests, and much more. All the points earned are credited to each customer account. Each customer is able to view the points available for each product since the points are displayed on each product. However, there are some products without points as they may already be on discount. The points allocated for each product could easily be adjusted at any time. In a similar manner, shop owners can easily adjust services at whichever time they choose. These points cannot be transferred and cannot be used to pay for the products. They can only be used to negotiate for a reward. Points are considered as one of the key factors when customers begin negotiating.

According to Online Toys Australia (2008), points are an integral part of incentivizing users and a great way of rewarding user activity. The motive is to use Dwesa points as a vital component to drive traffic back to the site, increase registrants, excellent motivation to promote specific campaigns and improve the services on *buy at Dwesa*.

3.3.2 Negotiation Overview

The unique function provided in this research, is for customers to be able to negotiate for rewards or for a discount with the system. DRP aims to create dialogue between the system and its customers. Customers make offers on the marked selling prices on each item after adding the items to their cart. Negotiation is a two-way process between the customer and the system and instant feedback is expected. An intelligent negotiation module is developed in this research.

Different factors are considered for the negotiation process before the decision on how to give a reward is made. Some of the examples that the system has to check include the transaction history, the number of points available, the season, overall sales during the negotiation time and the value of the order. Customers' details are also considered. Some of the details include age, income, location and number of dependants. Through negotiating, customers increase their chances of paying lower prices. As noted by MoneyhighStreet Staff (2007), one of the best ways of saving money, if you are buying an expensive item or service, is through negotiation with the supplier. Below are some of the best ways of negotiating which may enable those who are making use of *buy at Dwesa* to get rewards through negotiating.

- Rural shops need to sell the products to their customers.

Having goods, but no buyers, is a huge cost to shop owners so they need to shift their stock, maintain cash flow and replace old stock with new stock (MoneyhighStreet Staff 2007). Customers play an important role in the success of any business. Therefore, even on *buy at Dwesa*, customers are critical and thus the project intends to allow them to negotiate for rewards using points. Shops always compete for customers and very few good shop owners like to see customers walking away empty handed and in turn buy from their competitors (MoneyhighStreet Staff 2007).

- All shops need to make profits

Having shown that shops want and need to sell to customers, one needs to remember that shops and service suppliers need to make a profit. There is no point in asking for a big discount or reward if it means that the shop does not make any money from the deal. Good negotiation should benefit both the customers and the shop (MoneyhighStreet Staff 2007). This means that the shop benefits from a customer, by making a profit on the sale and by you, the buyer, spreading the word to your friends and family about the said shop. Customers have to benefit from the negotiation too, by getting a reduced price or discount of some sort and rewards. This supports the objective of Siyakhula Living Lab projects, where this project was deployed, which is to generate income for the poor people in the community.

- Customers should be reasonable when making offers

Negotiating for a 10% discount will probably be more effective than striking out for a larger reduction as this is more likely to make the deal unprofitable for the shop or supplier (CNET Networks, 2008). To be successful in negotiations, customers have to present a good reason for their request. By backing up a discount request with sound facts, customers are making a stronger negotiation stance and are more likely to succeed (MoneyhighStreet Staff, 2007). The above negotiation tips are applicable for all the customers purchasing on *buy at Dwesa* and increases their chances of getting the desired rewards. Therefore, the project gives points to customers, allows them to negotiate with the system and calculates the discount or reward to be communicated to the customer instantly. Figure 4 explains how the negotiation module works:

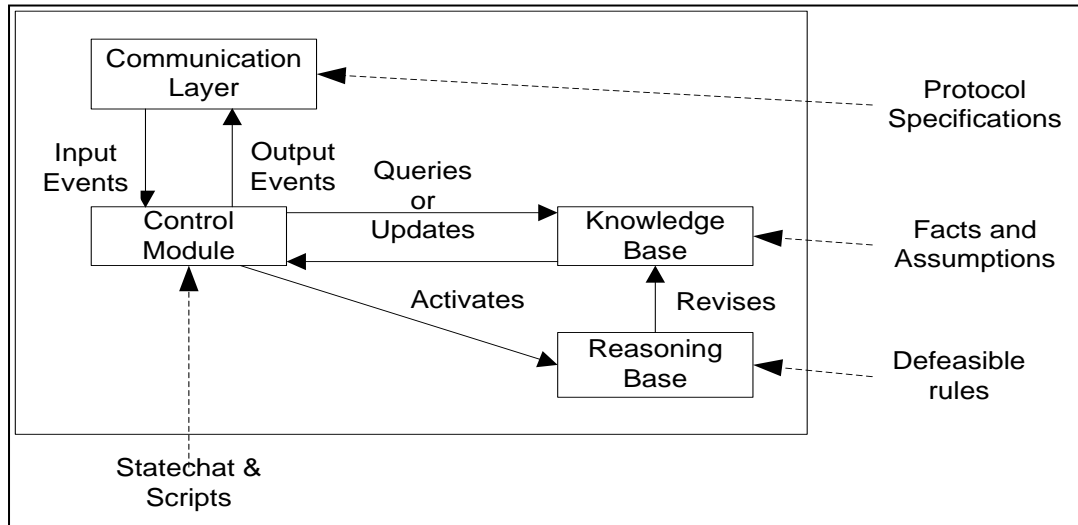


Figure Negotiation Application
Elsevier Science (2002)

Figure 4 above shows the negotiation application architecture composed of four modules: (i) a knowledge base which contains the history of the past decisions and interactions of the negotiator, including its current intentions (Elsevier Science, 2002). The date in the e-negotiation memory is used to make some of the random decisions during the negotiation process. (ii) A communication module responsible for receiving and sending messages to the other applications and interacting with the user (Dumas *et al.*, 2003). The communication module enhances the dialogue between the parties involved in the negotiation module. (iii) A reasoning module which encodes the decision-making as it will be connected to the database. It makes the decision based on the facts, which are available from the database. (iv) The control module that monitors all the modules. It checks on the module which is performing a task and allows the modules to take turns in carrying out different functions. To summarize, a negotiation strategy is composed of a state chart, a set of “scripts”, a defensible logic program, a set of initial facts, and the addresses of the other parties involved in the negotiation (Dumas *et al.*, 2003). These scripts have the important instructions, which are used during the negotiation process. All these factors that are considered for the negotiation are stored in the knowledge base. The detailed information on the negotiation module is provided in the next chapter of this research.

3.3.3 Rewarding Customers

Customers need reasons to visit a shopping portal, especially if one considers the vast shopping malls and e-Commerce platforms emerging in this world today (Campanelli, 2001). The best way to reward for the first time is rewarding for quantity rather than quality (Jere *et al.*, 2009b). However, according to Del and Mass (2007), a small reward such as a chocolate, a piece of fruit or a pen for every idea can be effective as this motivates the receiver. The idea in this thesis is to give the customers even small items and at the same time keep the business in the rural community growing.

We aim to encourage bulk buying or delivering many products at a time. Therefore, during negotiation, customers who buy in bulk will get more rewards. A list of all the possible actions to negotiate, list of points and list of all possible rewards is printed out. The customers have an option to view all these available points and rewards. A rewarding application involves several processes and factors before it is implemented. It requires proper planning and decision-making (Miller, 2008). Considering the amount of effort that goes into launching a rewarding application in many companies, it is essential to get the rewards right (Jenni Idea Management Software Service, 2008). The shop owner determines the computations on how the rewards are calculated. The shop owner should consider all the factors affecting the business and decide on the scale on how points are converted for the reward.

Figure 5 shows the sequence and main events that occur for the customer to get the rewards. The important factor is for a customer to have the points. Having points allows the customer to negotiate for rewards with the system. The diagram above gives a brief summary of how the DRP modules are linked. Customers have to register to be able to purchase from *buy at Dwesa*. After logging on, items can be added to cart and customers can make offers on the items added to their cart. An offer can be accepted or rejected. If the offer is accepted by the system, the customer should accept and proceed to make their payment.

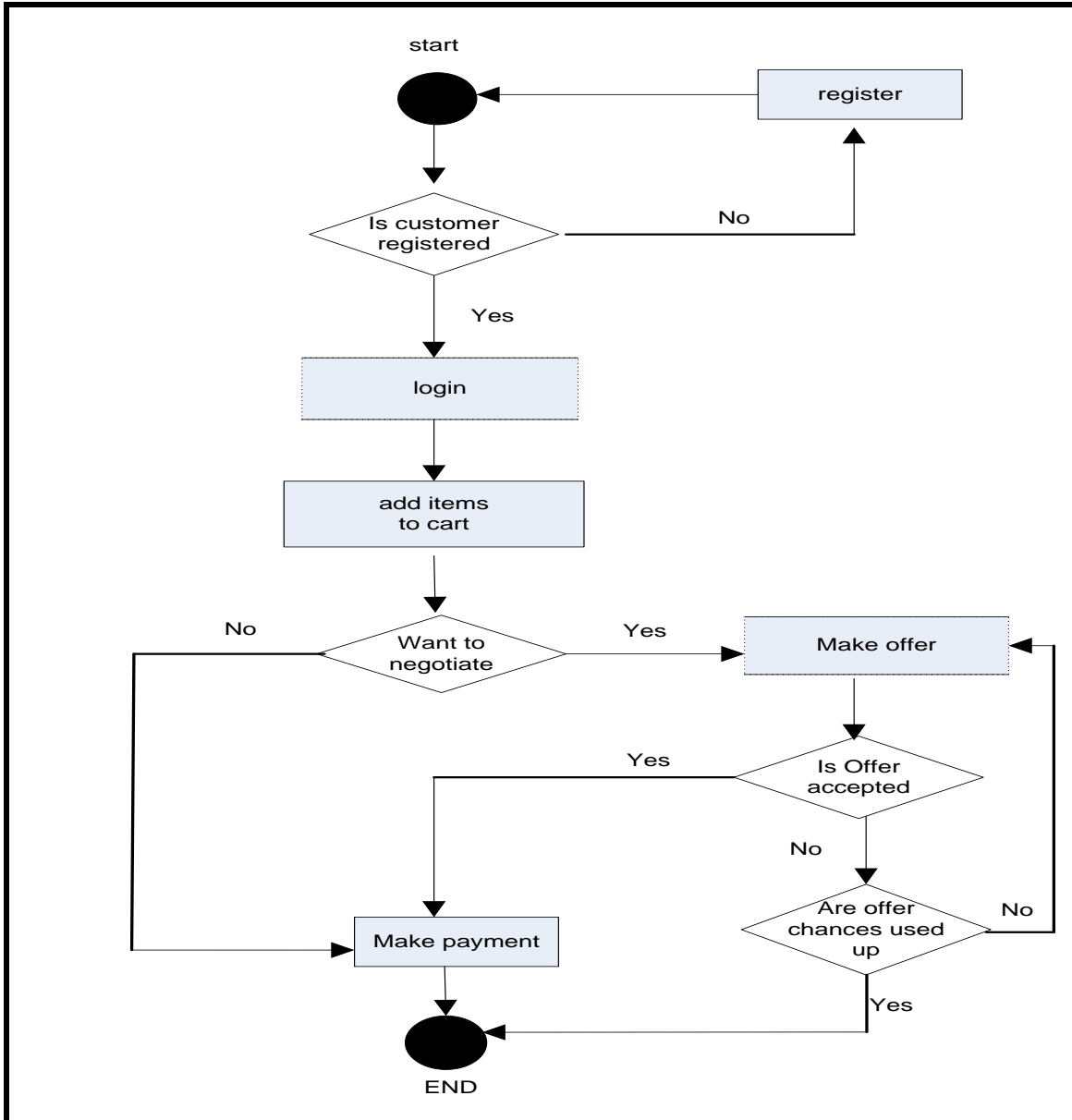


Figure Buying and Rewarding Process

3.4 Dwesa Rewards Program user roles

Dwesa Rewards Program (DRP) has three main entities involved. These include the system administrator, the shop owners and the customers. Each of these entities performs different roles in the system. The administrator is mainly involved in performing the back-end services. However, the administrator also plays an important role in ensuring that the front-end services are updated. Through the front-end, the shop owners are able to make changes to the items in the shops. Shop owners have to edit the points on items and determine the products to offer as rewards. Customers are those who access the system through the front-end to buy crafts products. They play an important role as they are the ones targeted for the development of this application. In this project we wish to satisfy customers with better services to improve the sales from Dwesa shopping portal.

3.4.1 Administrators' Roles

The administrators have the overall control and rights to monitor the rewarding application. They have access to all the modules of the system. Administrators can add or delete users and items in the shop since they manage the whole system. Their main roles include:

- Activate all the modules involved in the rewarding application. These modules include the allocation of points, negotiation and the rewarding module.
- Activate the log in credentials of the customers and the shop owners.
- Administer the entire rewarding application and perform all the necessary installations needed for the functioning of the application.

3.4.2 Shop Owners' Roles

The shop owners are the individuals from Dwesa community who design the artifacts and products for sale. They are the small entrepreneurs manufacturing the items and selling them for survival. They expect to benefit from the rewarding program as it is likely to increase their sales volumes. They have access to both the back-end and the front-end interfaces. Shop owners can edit product details from any of the interfaces. The shop owners' main roles are to assign points, enable negotiation factors and manage all the modules. The shop owners are regularly trained on basic computer-use and the system using computers at the surrounding schools which have computers. Understanding of these roles allows the development of the back-end that is easy to follow and simple to use. The roles are given in figure 6 below:

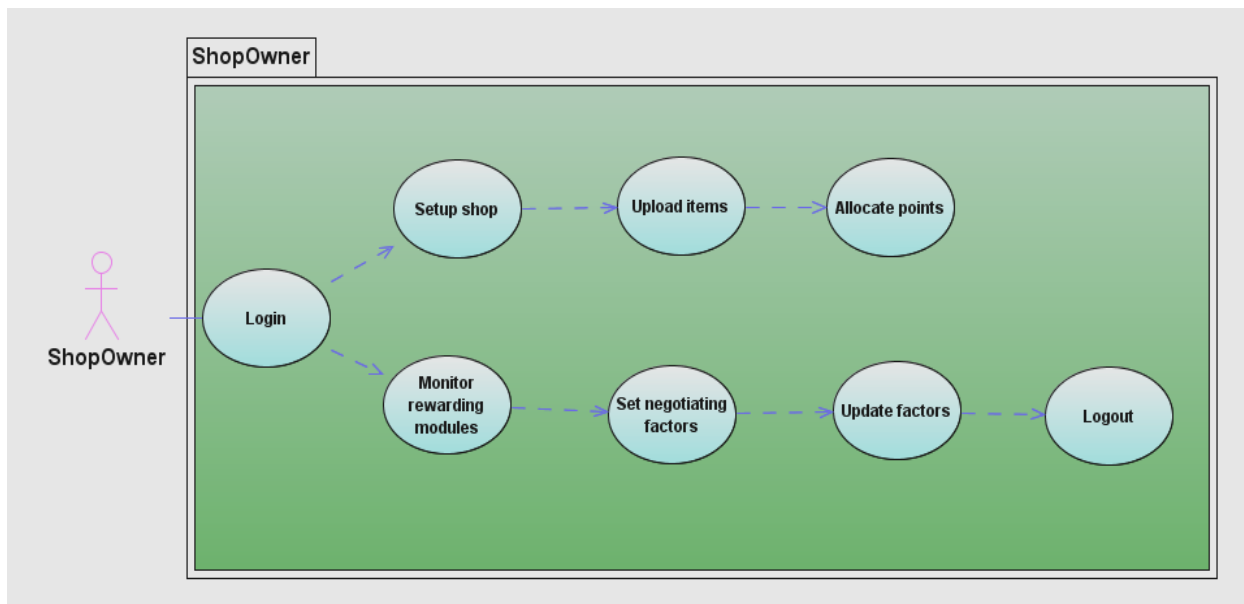


Figure Shop Owner Roles

3.4.3 Customers' Roles

Anyone browsing the rewarding application website to purchase Dwesa products is referred to as a customer. The requirements for customers in the system are to allow them to acquire and accumulate points and view their accrued points. Customers should get rewards based on these points. Their roles in relation to the system are to:

- Log on to their accounts, register, refer friends and purchase online, and

- Seek points, view points and negotiate for rewards by making offers.

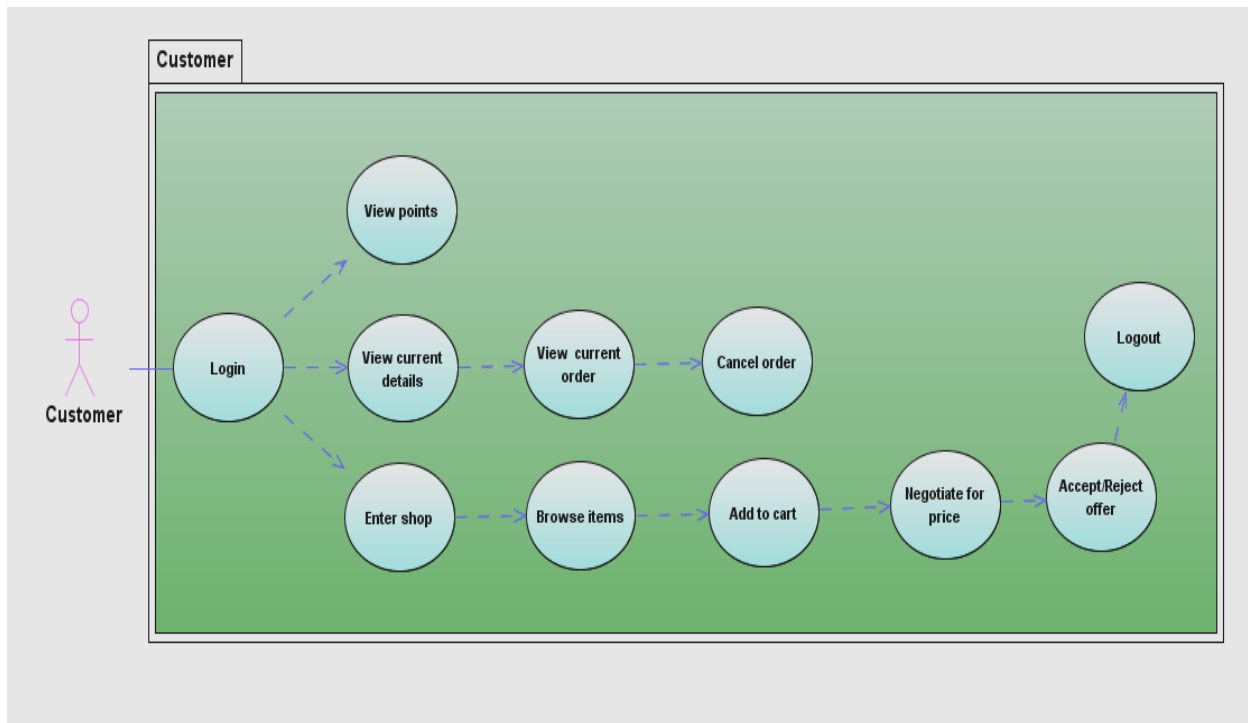


Figure Customer Roles

Figure 7 shows a summary of the main activities performed by the entities of the system. The main entities of the system are the administrator, the shop owner and the customer. It is clear that all these entities are able to view the points. The customer can only negotiate with the system, referred to as the shop owner in this thesis. The administrator is the only entity who manages the modules. The shop owner does the allocation of points. The shop owners are able to do this through the front-end of the system. However, the administrator can also assign the points.

Figure 8 below shows the main functions performed by each entity involved in the operation of the rewarding application. It shows that the customer initiates the whole process of rewarding. When the customer makes a request, either the shop owner or the administrator has to provide the service. All these services are enhanced by the availability of the main rewarding system. The customer qualifies for and requests points through performing functions on the shopping mall, such as registration, buying online and referring friends. The request has to be approved by the system administrator or the shop owner. The points are assigned to the products and hence the customer gets the points.

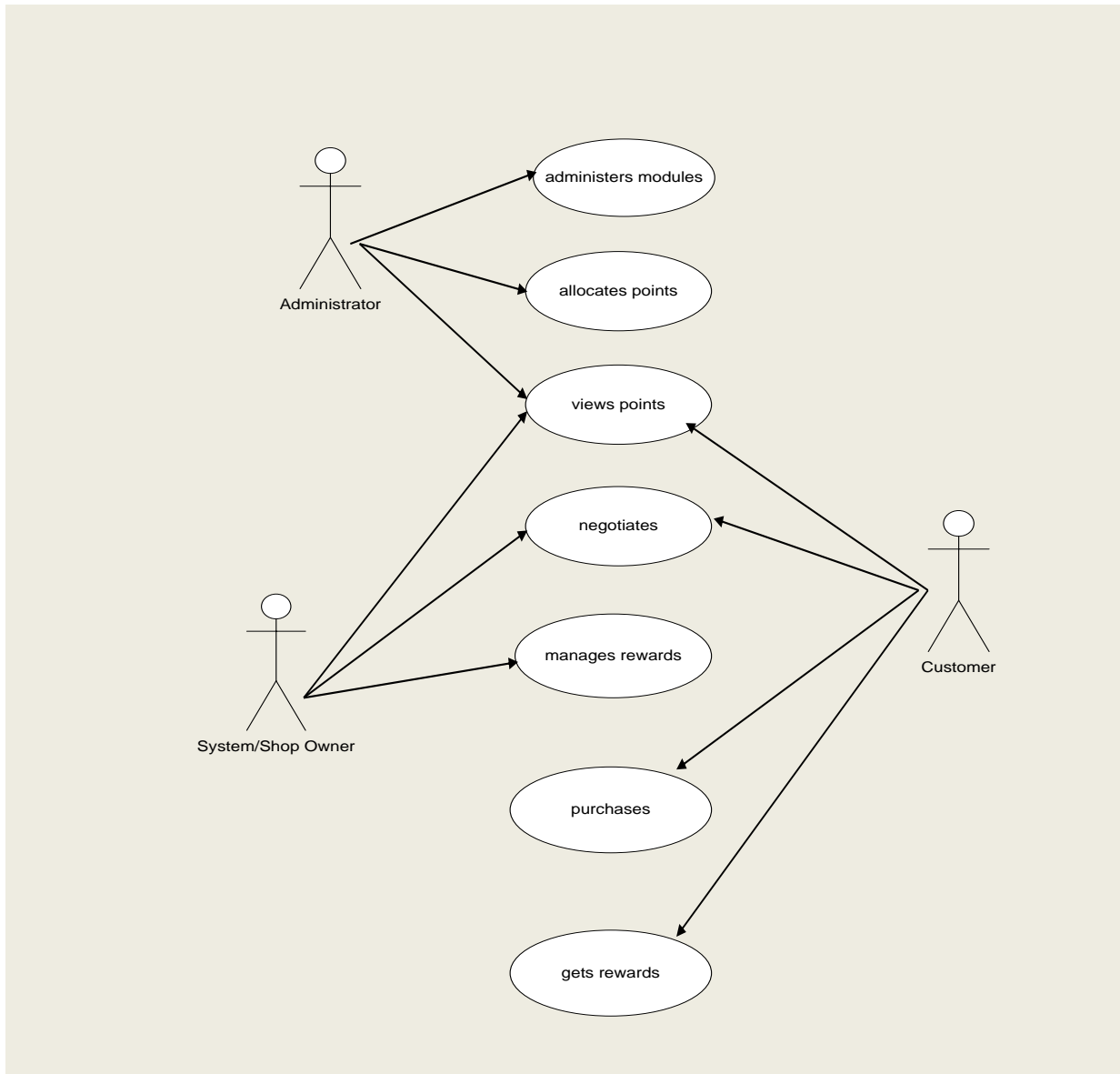


Figure Customer Roles

3.4.3.1 Customer Sequence of activities

A customer logging on to the system gets authenticated and is allocated a shopping cart. On successful authentication, he/she is presented with the list of stores available. On entering the store he/she is presented with the list of items available at that shop. Figure 8 shows the sequence of events that occurs when a customer gets into the shopping portal to buy any of the items without negotiation. This whole sequence has been captured by following the sequence diagram in figure 9.

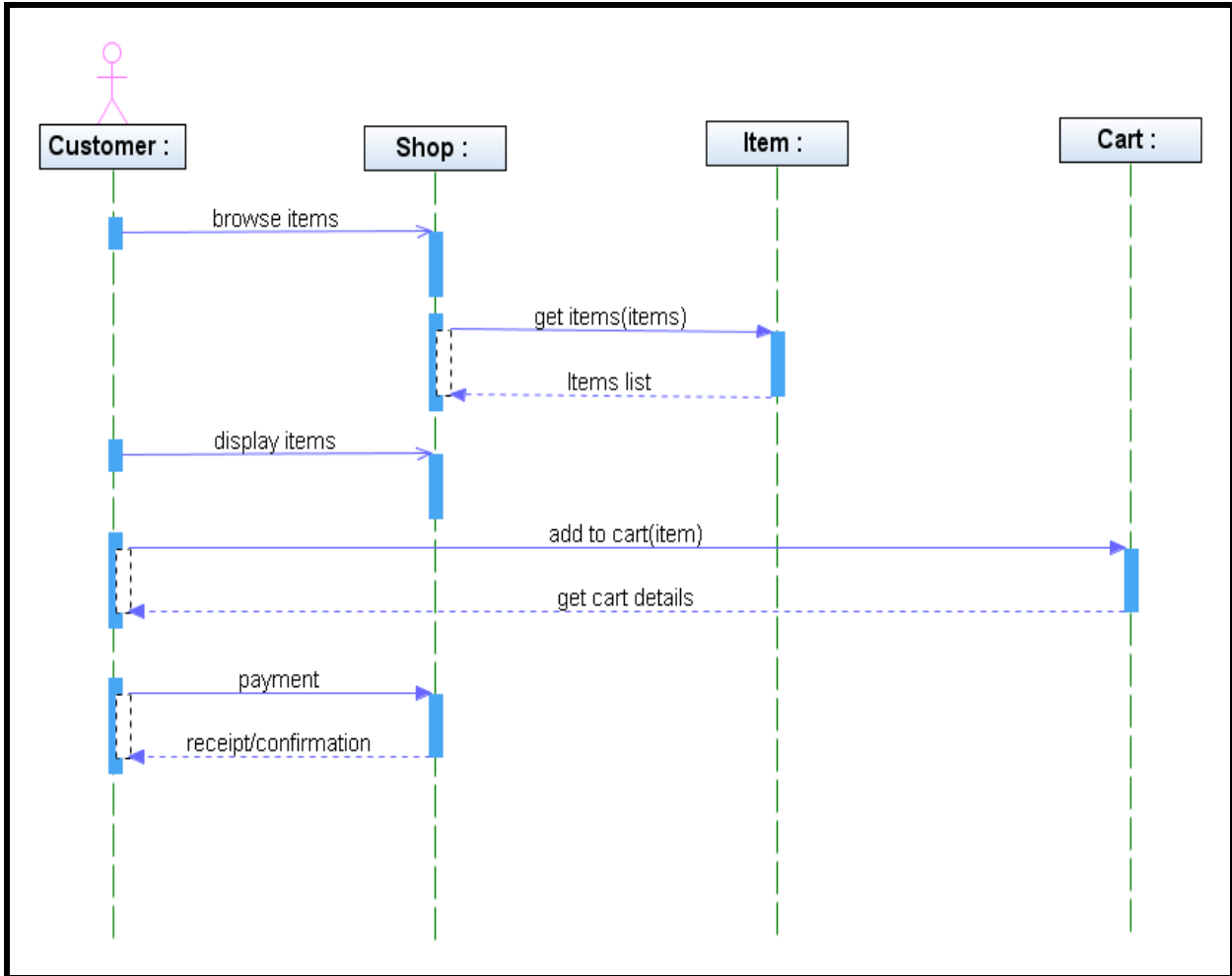


Figure Customer buying sequence

However, in cases where the customer has to negotiate for the prices, figure 10 sequence diagram explains the steps.

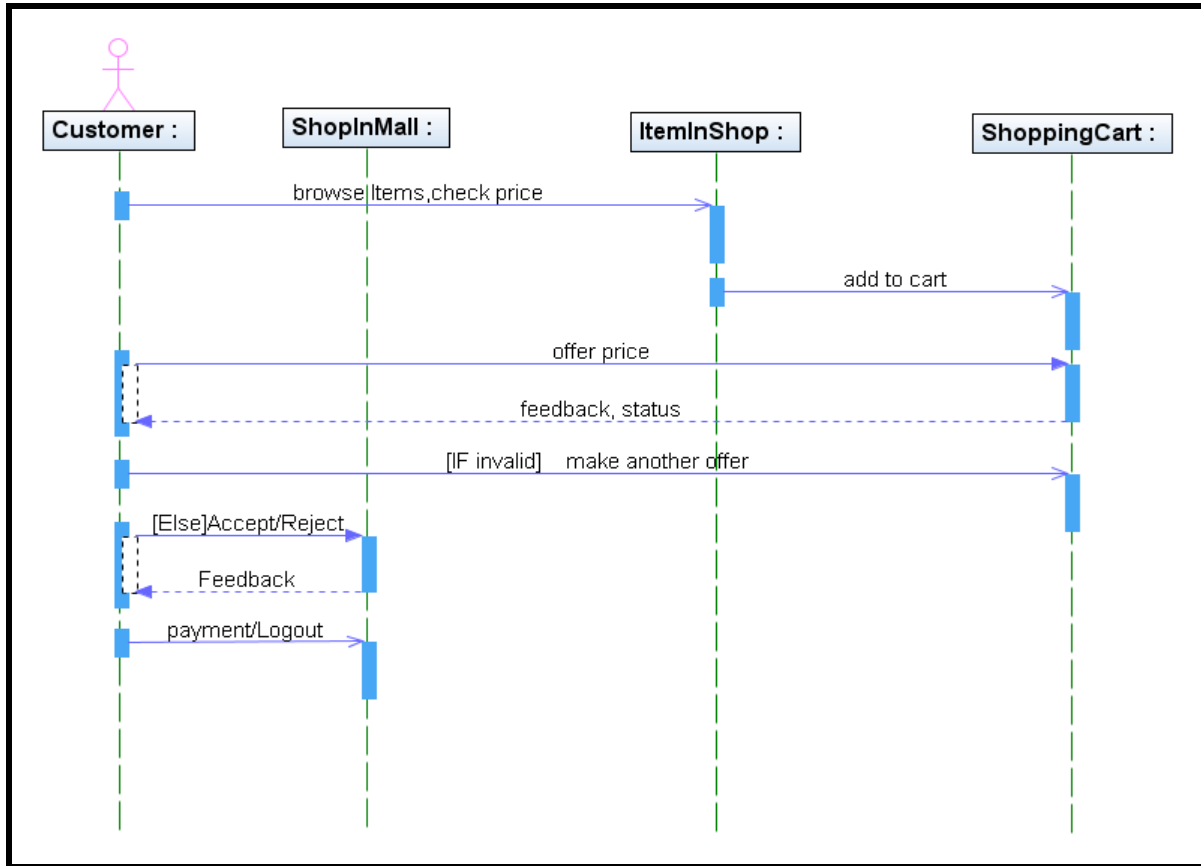


Figure Customer making offer sequence diagram

Figure 10 above explains a customer making offers after adding items to his/her cart. There is instant feedback between the customer and the system. After making an offer the system has to validate the offer and sends feedback to the customer. The customer has the final decision on whether to accept or reject the offer, and proceed to make payment or just exit the shopping portal.

3.5 Conclusion

The chapter has explained the methods and technologies that are used to design the modules. It gives an overview of the requirements that are necessary for the development of the rewarding application. The activities and the main functions performed by the different users of the system are mentioned. The next chapter explains in detail the main module of this research, which is the negotiation module.

CHAPTER 4: DWESA REWARDING PROGRAM

NEGOTIATION MODULE

This chapter gives an overview of one of the modules that makes up the rewarding application. The chapter explains the different types of negotiation and negotiation architectures. The negotiation process and the main activities which occur during the negotiation process also form part of this chapter. It explains the factors and rules that are used during the negotiation and rewarding of customers buying at Dwesa.

4.1 Introduction

As the amount of commercial transactions carried out on the Internet increases, the interest to partially or totally automate the negotiation of the terms of these transactions has rapidly become an interesting research topic (Elsevier Science, 2002). This chapter discusses the development of an intelligent negotiation module to enhance an e-Commerce platform.

- Definition of Negotiation

Negotiation is a process by which individuals who have both shared and opposed interests and want to resolve a conflict, strive to reach a mutually acceptable agreement, as defined by Jaime Tan, (2008) and Johnson and Johnson, (1997). Negotiations are aimed at reaching a settlement, which specifies what each party gives and receives from the other. Hence, negotiations can either be *distributive*, where one party benefits only if the opponent makes a concession or *integrative*, where two parties work cooperatively to seek a mutually beneficial solution (Jaime Tan, 2008; Johnson and Johnson, 1997). Thus, for each negotiation process there is an offer and an acceptance. This means that negotiation is like a contract; in negotiation the parties are aiming to agree upon something. Bichler *et al.*, (2003) define negotiation as an iterative communication and decision making process between two or more negotiators (parties or their representatives) who:

- Cannot achieve their objectives through unilateral actions,
- Exchange communicative acts comprising offers, counter-offers and arguments,

- Deal with interdependent tasks,
- Search for a consensus which is a compromise decision.

Traditionally negotiation has been done through face-to-face interactions. However, with the changes in technologies, advances in the telecommunications and development in e-Commerce systems, negotiation is now possible using electrical gadgets such as computers. Customers are now able to negotiate when buying products online. With the advent of e-Commerce, online businesses have become more popular than before. Placing online orders, making payments electronically and finding information about the products and the vendors have become easier (Chhaya, 2002). Despite the comfort that e-Commerce has brought with it, humans are still involved in most of the important processes of business, for example, in making decisions in all phases of buying and selling (Chhaya, 2002).

Negotiation is one of the key factors in commercial systems involving a lot of decision making and tradeoffs between various factors. Some of the practical applications that assist users in negotiation are Auctionbot, Kasbah, Tete-a-tete, e-Bay (Maes *et al.*, 1997). Most business transactions in e-Commerce involve negotiation to settle on the most suitable price for both parties (Jere *et al.*, 2009b). During negotiation, individuals or organizations have to make decisions of a varied nature to attain their objectives. The purpose of the negotiation module discussed in this thesis is to reward loyal customers, give customers the opportunity of a counter-offer on prices and to enhance the e-Commerce platform in a marginalized area.

The functions that the negotiators use to increase or decrease their offers and counter-offers as a buyer and as a seller are defined as follows (Chhaya, 2002):

For Buyers

$$\begin{aligned}
 & \textit{If } max_price > std_price \textit{ then} \\
 & \textit{Offered price} := std_price - D \\
 & \textit{Else} \\
 & \textit{Offered price} := max_price - D
 \end{aligned}$$

For Sellers

If min_price > std_price then
Offered price := min_price + D
Else
Offered price := std_price + D

Formula For buyers and sellers

Where, *std_price* is the market price provided by the matchmaker and *D* is a constant. It is calculated based on the current situation of the market (Chhaya, 2002). For both the buyer and the seller the values of *D* should not exceed their preferred prices (*R*). Therefore, it can be concluded that buyers always aim to pay less when buying. In contrast, sellers aim to sell at higher prices.

4.2 Negotiation Architecture

In designing a negotiation module, the following negotiation terms are crucial:

- *Negotiation protocol* consists of a set of rules that govern the interaction among the negotiation parties. Some examples of the rules are: permissible types of participants: negotiators, third parties; negotiation states: accepting bids, negotiation closed; valid actions of the participant in particular states (Sierra *et al.*, 1997)
- *Negotiation objects* are ranges of issues over which agreement must be reached.
- *Reasoning model* is the apparatus that participants employ in order to achieve their negotiation objectives. For instance, it is a mechanism by which the next counter-offer is calculated. Some of the strategies developed are argumentation, persuasion and heuristics-based. Obviously, the selection of the reasoning model depends on both the protocol and the negotiation object (Sierra *et al.*, 1997).

In order to have the required feedback, the architecture of the negotiation server needs a component to record the history of negotiations (Haifei *et al.*, 2005). For example, the history of an on-going negotiation transaction (i.e., proposal exchanges) can be used to determine the speed of concession applied by the counterpart (counterpart concession). In addition, the system can

“learn” from experience (i.e., the history of previous negotiation transactions with a counterpart) to generate new policies (i.e., mappings from negotiation contexts to negotiation goals). And also strategies (i.e., mappings from negotiation goals to negotiation plans to be explained in the next section) and/or to modify the existing policies and strategies dynamically at run-time (Haifei *et al.*, 2005).

The proposed negotiation application follows the basic structure of a negotiation server with different components such as these explained below (Haifei *et al.*, 2005). Negotiation Transaction Manager includes:

Negotiation Scheduler: Responsible for initiating a new negotiation transaction / session when the Negotiation Server receives a transaction / session message. *Negotiation Session Processor*: Responsible for processing a negotiation session. A *negotiation transaction* is defined as a sequence of negotiation steps carried out by a pair of negotiation servers that lead to an agreement or disagreement in a negotiation process (Haifei *et al.*, 2005). Each negotiation step is called a *negotiation session*. These sessions will be managed by the shop owners.

- *Event/Trigger/Rule (ETR) Server*: Responsible for receiving events from the Negotiation Transaction Manager and triggers the proper decision-action rules to relax constraints, to inform the user (Haifei *et al.*, 2005). This is a connection link to the database and the customers.
- *Cost/Benefit Module (CBM)*: Responsible for performing cost-benefit evaluation of alternatives based on the pre-registered preference scoring and aggregation methods provided by the negotiation parties (Haifei *et al.*, 2005). This is the intelligent module that is responsible for decision making.
- *Negotiation Messaging*: Provides the sender and receiver for Negotiation Servers to communicate with each other using a push communication model.
- *Negotiation Repository*: Provides a persistent storage to store a variety of negotiation data. This makes use of the database. These terms have been explained since they have assisted us in understanding the negotiation module.

4.3 Negotiation Process

The diagram below shows a FlexFlow modeling of a simple negotiation between a buyer and a seller (Reuter and Schwenkreis, 1995). The top right transition shows that on the event “Offer”, the action “RecordOffer” is taken (Rakesh *et al.*, 2002). The engine checks the guard specifying that the user making the offer is the “Buyer”. There is no action corresponding to the “Accept” or “Reject” events. On entry to the final state “Deal” a “RecordDeal” action is taken.

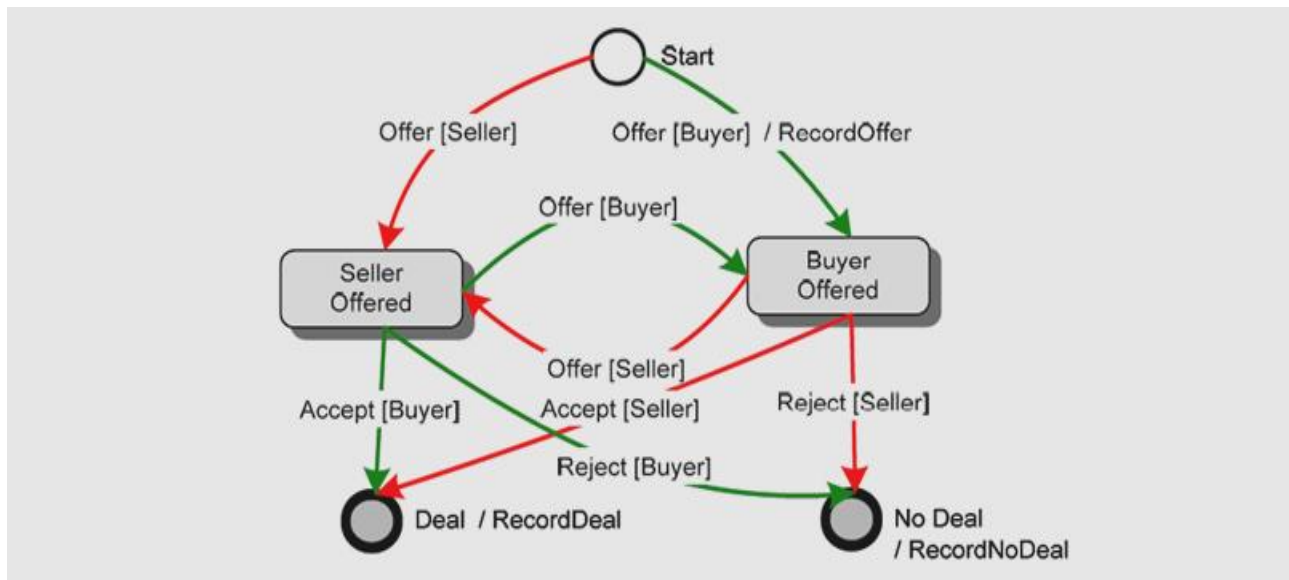


Figure Negotiation Process
(Rakesh *et al.*, 2002)

Figure 11 shows that for every negotiation there is an offer and an acceptance. Figure 11 shows the communication process between the system and the customers. Just like any negotiation application, the module in this research is similar to the other online negotiation processes. There should be an agreement between the parties, and if there is no agreement it means there is no deal. Again, if there is agreement then there is an acceptance of the offer.

The negotiation process can be divided into four stages which include information collecting, searching/offer gathering, negotiating, and evaluating (Reuter and Schwenkreis, 1995). There is a need to gather the necessary information required to start the negotiation process. Information such as customer details, location, customer age, customer buying behavior and the order history

of the customer are gathered to have clear negotiation goals. In decision making, these factors have to be analyzed and the process may take a while when trying to resolve the conflict (Rakesh *et al.*, 2002). Therefore, to overcome the problems in delay, in the development of this application, the processing time has a time span and different sessions used to manage the time frames.

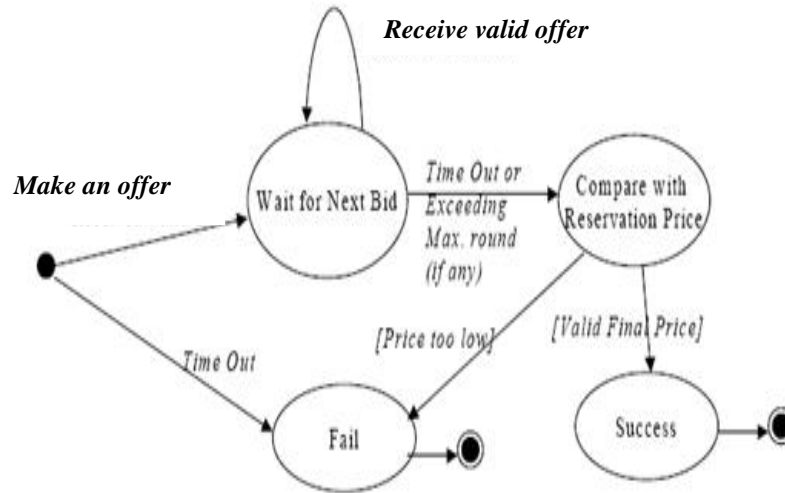


Figure Negotiation Counter-offers
(Dickson, Chiu and Patrick, 2003)

Figure 12 above shows that during negotiation customers can make offers. The reasoning module within the negotiation module makes a decision on the available offers. There is computation of the final price before the deal is sealed and the decision is communicated between the negotiating parties. Offers and messages within the negotiation application expire, hence negotiating customers have to complete the process before the negotiation session expires. Making offers and offer evaluation:

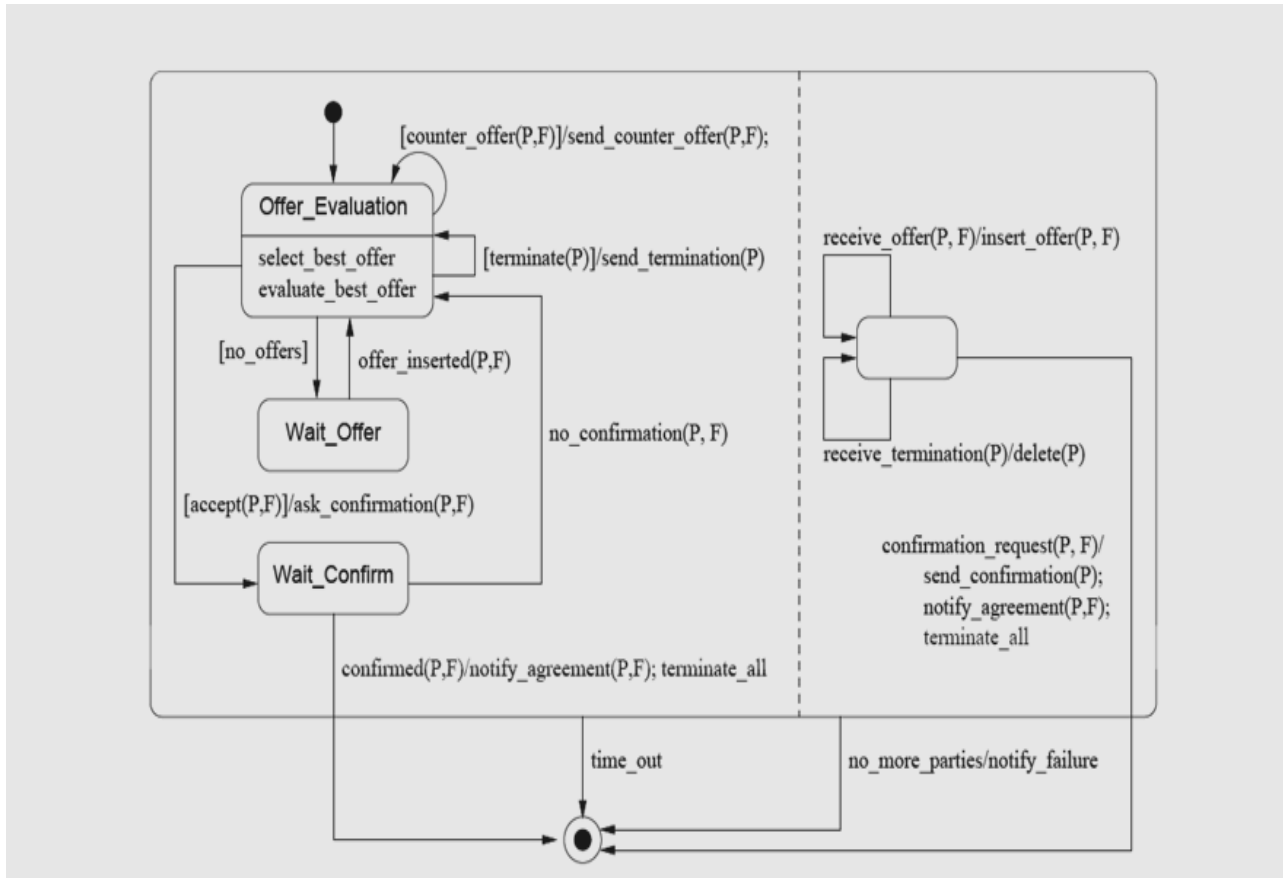


Figure Negotiation Control Module
(Dumas *et al.*, 2003)

Figure 13 shows how the control module of the negotiation application works. One needs to wait for offers and make evaluation on the available offers, and then make a final decision to be communicated between the negotiation parties. Notice that it is not the buyer but the sellers who are responsible for generating the initial offers (Dumas *et al.*, 2003). Accordingly, we use the term “offer” to designate the prices proposed by the sellers, and the term “counter-offer” to refer to the prices proposed by the buyer. The reasoning module of the negotiator is composed of two separate logical programs: one for selecting the next offer to be evaluated, and the other for evaluating an offer (Dumas *et al.*, 2003).

We consider a negotiator responsible for negotiating a price with several potential sellers on behalf of a buyer. Offers sent by the sellers are arranged in a queue. The outcome of the evaluation of an offer can be one of three actions: accept the offer, propose a counter-offer, or terminate the negotiation with the corresponding party. If an offer is accepted, the negotiator asks

the other party to confirm the agreement and upon receiving confirmation, the negotiator terminates the whole negotiation process (i.e. all the threads). If on the other hand a message confirming the refusal is received, or the confirmation message is not replied to after an agreed delay, an occurrence of event “no confirmation (P,F)” is generated, and the negotiator continues to negotiate with the other parties (Elsevier Science, 2002).

4.4 Negotiation Context and negotiation goal

Every business enterprise operates in a mini-world of business, in which the enterprise has access to some of the information, material, financial, and personnel resources that exist in the real world (Haifei *et al.*, 2005). All these resources have to be identified and acquired so that the negotiation process starts. The information required may be on the inventory details, customer information and the current market conditions, all of which are important for setting the goals of negotiations. Some of the information may be stored in the enterprise’s local database and/or application systems. Others may be accessible from remote databases or application systems, for example, calling the methods of remote objects that encapsulate these databases and application systems (Haifei *et al.*, 2005).

During the negotiation process, it is necessary to have a negotiation goal. In the development of this e-negotiation module, the goal is to allow customers to counter-offer the prices and have a chance to negotiate for desired prices. Of course, the idea is to sell the products above the cost price and make customers get some rewards through negotiation. The negotiation goal is aimed at creating a customer loyalty relationship, thus the idea is to let those customers who deserve to succeed during the negotiation process get a fair deal based on their order history and all the necessary details from the database.

4.5 Negotiation strategies

There are various techniques and strategies used for coming up with the negotiation rules, goals and planning. Thus, having gathered some facts, the following are some common negotiation strategies (Rahwan et al., 2001). These strategies enhance the decision making in the negotiation process. According to Rahwan et al., (2001), these are some of the negotiation strategies:

- **Desperate Strategy:** This is a very simple strategy in which the time constraints may be important and the negotiator wants to close a deal fast. In this strategy, as soon as a sub-negotiator finds an acceptable offer, the coordinating negotiator accepts it and sends messages to all other sub-negotiators to terminate their negotiation (Rahwan et al., 2001). If more than one sub-negotiator comes up with an acceptable offer, the one with the highest utility is chosen while the rest are terminated.
- **Patient Strategy:** In this strategy, even if an acceptable deal is found by one or more sub-negotiator(s), these negotiators are asked to wait while other negotiators are asked to resume their negotiations. Once all sub-negotiators complete their negotiation process (whether with success or failure), the best offer is chosen (Rahwan et al., 2001). This strategy guarantees that the best possible deal can be reached, but does not give regard to time constraints. This might be a significant limitation in a marketplace with too many potential suppliers to negotiate with. One variation of the patient strategy is one in which a time limit is set by the user, within which if no better deal was found, the negotiation terminates and the best deal at that time wins.
- **Optimized Patient Strategy:** In this strategy, the coordinating negotiator uses information about one negotiation outcome to influence the performance of other sub-negotiators. The constraints on the utility for the other sub-negotiators is updated in order to avoid unnecessary deals which are not as good as the one already found (Rahwan et al., 2001). For example, if the accepted minimum total utility is 5, and one sub-negotiator has found a deal with utility 7, there is no point in other sub-negotiators reporting back a deal with utility 6 even though it is an acceptable

deal (according to the initial constraints). This also ensures that no sub-negotiator offers an offer that is worse than an offer received by a fellow sub-negotiator.

- **Strategy Manipulation Strategies:** In this class of strategies, the coordinating negotiator may modify the negotiation strategies of different sub-negotiators at runtime (Rahwan et al., 2001). For example, after securing a deal, other sub-negotiators can exercise a take-it-or-leave-it strategy with their opponents.

The understanding of these strategies allows the developer to have an overview of all the alternatives available during the negotiation process. These different strategies were used during the development of the negotiation module and give an understanding of how the negotiation strategy should process and send messages.

4.6 Negotiation Rules

For the negotiation application to function fairly and properly, the negotiation rules were defined and set right. These rules determine how the overall decision is computed and used by the reasoning module to provide feedback. For the development of the DRP, we have come up with rules that are used for the development of the negotiation module. We aim to make the negotiation process as real as if shopping face-to-face. We have also designed simple rules that can be modified at any time. Different factors were considered for negotiation. Most of the factors are captured when the customer is completing the registration form. All these details are stored in the database. Some of these factors include the customer's age, income, order history and number of points. However, all these factors are dynamic and can be modified at any time.

Some of the negotiation key rules are:

- Negotiation can only be done after adding items to cart;
- Most items can be negotiated for;
- Customers should negotiate between the Cost price and the Selling price;
- No items can be negotiated below the cost price;
- Negotiation makes use of functions, for example, negotiation by age;

- Customers have to make offers;
- A valid offer is automatically calculated. This should be greater than cost price;
- A certain percentage to be deducted per customer is calculated;
- The final price that each item could be negotiated to is calculated per customer.

In coming up with these rules we have considered the nature of the business and its size. We have noticed that rural entrepreneurs in Dwesa wish to sell as many items as possible at the same time to earn a living from the sales. Therefore, the rules we listed above are meant to keep the business going and allow the shop owners to reward customers and also get profits. Hence, it should be clear that for the DRP there is no item that is sold below the cost price after negotiation. Having considered the rules above, different formulas were used for the development of the negotiation modules. Some of the formulas to support the above mentioned rules are:

For making any offer:

Offer_Price > Cost_price (Valid offer)

If Offer_Price < Cost_price then

Offer_Price is invalid

Formula Validating offer

Percentage discount to be deducted:

$$\text{per_final} = (\text{per_final}/\text{high_poss_val}) * 100.$$

This gives the value in percentage that should be considered for the valuation of the offers made by the customer. *High_poss_value*, is obtained from the database after getting all the activated factors which are in the database.

Negotiation prices

$$\text{diff} = \text{Selling_price} - \text{Cost_price}$$

Since the *Offer_Price* should be between the *Cost_Price* and the *Selling_Price*, calculating the difference between these prices help in the final price calculated during negotiation.

Final Acceptable negotiation price

$$final_price = Cost_price + (diff - (diff * per_final/100))$$

Formula Acceptable price

Since the value of *diff* is explained above, and *per_final*, the *final_price* which would be accepted by the system is calculated from the recent formula.

From the formula:

If Offer_Price >= final_price

Then Accept offer

Else Send a message offer is too low

Formula Low offer

Table Negotiation factors

Factor Name	LOW	MEDIUM	HIGH
Age	5	15	20
Income	0	10	15
Points	5	20	30
Order History	10	15	20

In setting up the negotiation rules, the above table shows the details that could be in the database with the factors to be considered and the different values. The values differ from customer to customer. The details, according to which customers' inputs are calculated and ranked differently, are listed in the above table. For example, for a customer with age greater than 65, the value of 20 is given, indicating that greater priority is afforded to pensioners. Again, someone with points greater than 1000, is regarded as a loyal customer and we aim to promote such

people, thus their value is 30. This means customers with higher points are given higher priority and percentage discounts during negotiation.

In this thesis, several factors were considered for the development of the negotiation module. These factors form most of the rules to be used during the development of the negotiation application or module.

4.7 Analysis of Negotiation factors

We have identified different factors to be used for negotiation. These factors could be used in setting up the negotiation rules. However, those listed below are some of the examples of the negotiation factors we have used for the DRP negotiation module. Therefore listed below are some of the factors that could be used for negotiation.

- **Negotiation based on Age**

Those customers between 18 years to 25 years are classified as the youth and may not be working. All the customers above 65 are old. These two groups of customers stand a higher chance of negotiating for lower prices and more rewards. Customers between 26 to 64 years form part of the working class and customers in this age group have the lowest percentage discount when negotiating on the basis of age. In negotiating with these customers various other factors like the points available and the order history are considered.

- **Negotiation based on Cost Price / Selling Price**

In making the negotiation rules, we have considered that there is no product that is sold below the cost price or no reward will be offered at the expense of the business. Thus, there is a need to carefully consider the counter-offer prices from the customers. The moment that the offer price is less than the cost price the negotiation process ends. Hence, the relationship between the cost price and the selling price is very critical in making the decision.

- Negotiation based on Profit Margins

The volume of sales and the profit margins also come in during the negotiation process. If the business is making a loss due to low sales volumes, then chances of getting rewards and paying less if negotiation is initiated are very high. Again, if the business is just breaking even with low sales, having a positive attitude during the negotiation may also allow customers to get more. However, in times of high sales volume and high profit margins, it may be difficult to negotiate and win much. Of course, rewards are there, but a lot of factors on the customer details and the order history are to be considered, which makes it difficult to win during the negotiation.

- Negotiation based on Order History

Considering the frequency of the customers, value of the order and the highest amount which customers have spent also form part of the negotiation process. Those customers who are always buying in bulk and spending more have higher chances of winning when negotiating.

The above are the main factors we have considered for the development of the negotiation module. However, there is a level of randomness in some cases when the negotiation decision is made. The system may add a random element to simulate the non deterministic nature of real life negotiation decision based on the previous decisions available in the negotiation application knowledge base. The above factors were considered to explain how the rules explained earlier in the chapter have been derived from. Of course, these factors are dynamic and can be modified at any time by shop owners.

4.8 Conclusion

The negotiation module forms the greater part of the rewarding module discussed in this thesis. It describes an intelligent application that allows customers to give their price offers and get instant feedback while shopping online. The negotiation module is dependent on the other modules, for instance it relies on the points allocation module and the database for its reasoning. The final reward is determined by the power of the customer to negotiate. Therefore, this research consists of three main modules namely points allocation, negotiation and the rewarding modules. However, we decided to concentrate on giving details on the negotiation module to fully explain the main contribution of this thesis to e-Commerce businesses in marginalized areas. The next chapter is on the actual development of all the DRP modules.

CHAPTER 5: REWARDING MODULES HIGH-LEVEL DEVELOPMENT

This chapter describes the design of the Dwesa Rewarding Application program using LAMP architecture. It also explains the development of all the rewarding modules. The chapter gives the entire architecture of the system and the database models.

5.1 Introduction

This Chapter forms the basis for enabling the development of all the modules required for the functioning of the project. The overall system diagram, user interfaces, back-end interfaces and the database structure are the main areas explained in this chapter. The chapter describes the different components necessary for the whole system development.

5.2 System Architecture

The previous chapter explained the negotiation module in detail. However, it should be noted that there are other modules that are important for the development of this rewarding system. Therefore, this chapter combines all the modules and explains the development of the complete rewarding and negotiation application contained in this thesis. The diagram below shows the basic architecture of the DRP application.

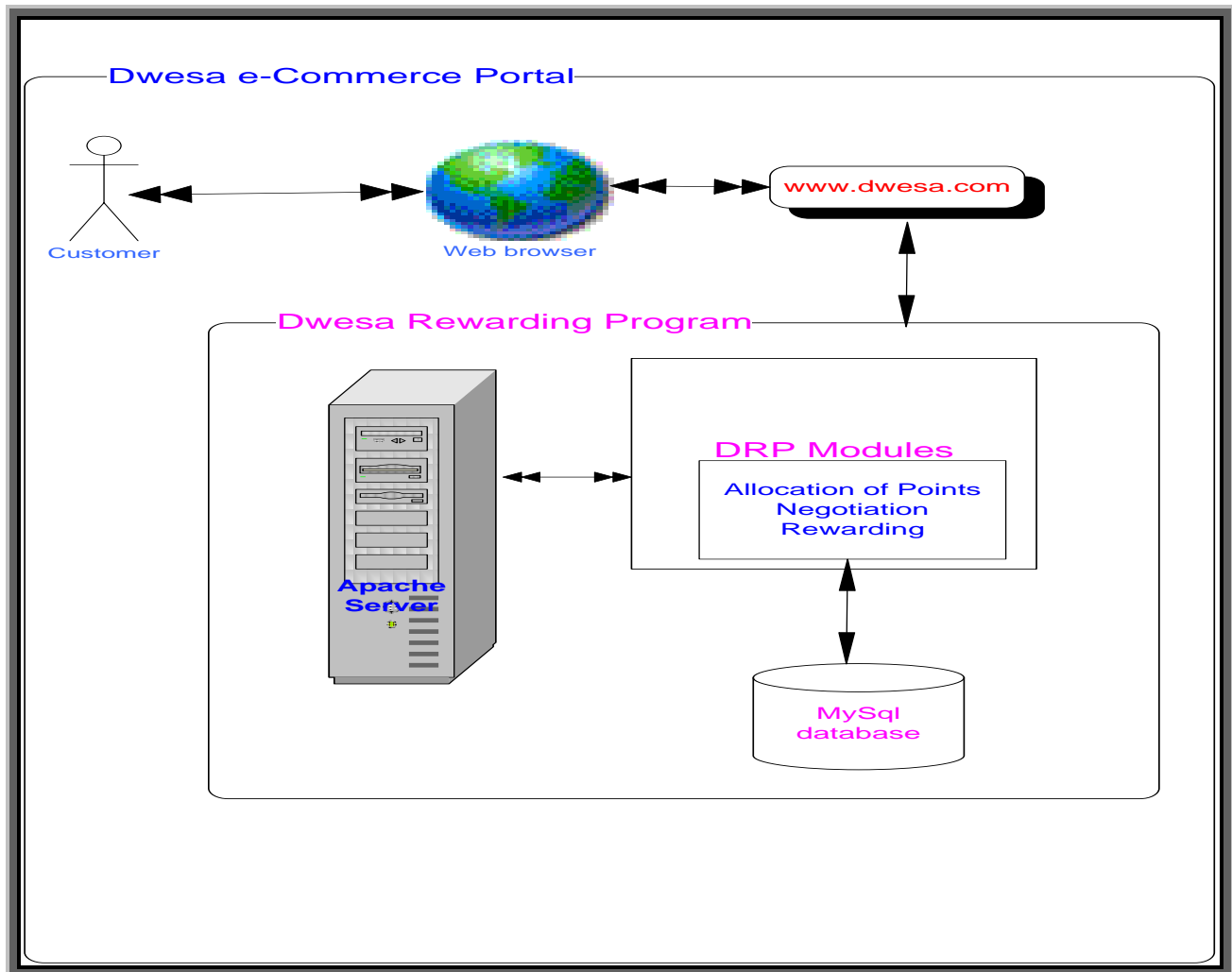


Figure System Architecture

There is interaction between the customer and the main modules of the system as shown in Figure 14. Customers access the system through the web browser. When the customers access the Dwesa shops, a Web Server is contacted to get the requested information. The sole task of the Apache HTTP server is to accept incoming HTTP requests and to return the requested resource in an HTTP response based on HTTP protocol (Njenje, 2008). The PHP container handles the execution of the PHP code within the process context of the Apache HTTP server. During this time, session management occurs. The session management is handled transparently by the PHP applications, using the HTTP GET/POST standard to set a session within the user's Web Browser. The session is maintained until the user exits the browser. The PHP container uses

the PHP library installed under Linux, to execute certain functions such as connecting to a remote mail server using the SMTP protocol. PHP has built-in functions that enable the connection to MySQL database. The database stores all the customer details captured during the registration process. The Apache servers are used to link the PHP files and the database. All the modules of the system rely on MySQL database.

5.3 Rewarding Modules objects

Before the actual development of the rewarding application is discussed, identifying some key objects, entities and their attributes was important. The given class diagram (Figure 15) played an important role in the development of the rewarding modules. The motive in this research is to have intelligent modules to improve the current *buy at Dwesa*, so having taken into account the current shopping mall website's functions, the figures 15 and 16 were designed to help in the physical development of the rewarding application.

The DRP application creates a set of different shops, for instance the art and craft store and the clothing store. The application welcomes customers, performs authentication for them and allocates the shopping cart. The application presents the customer with a list of different shops available and allows the customer to shop at any of the shops. These shops can be modified by the shop owner at any time. Figure 15 below helps to explain the whole process.

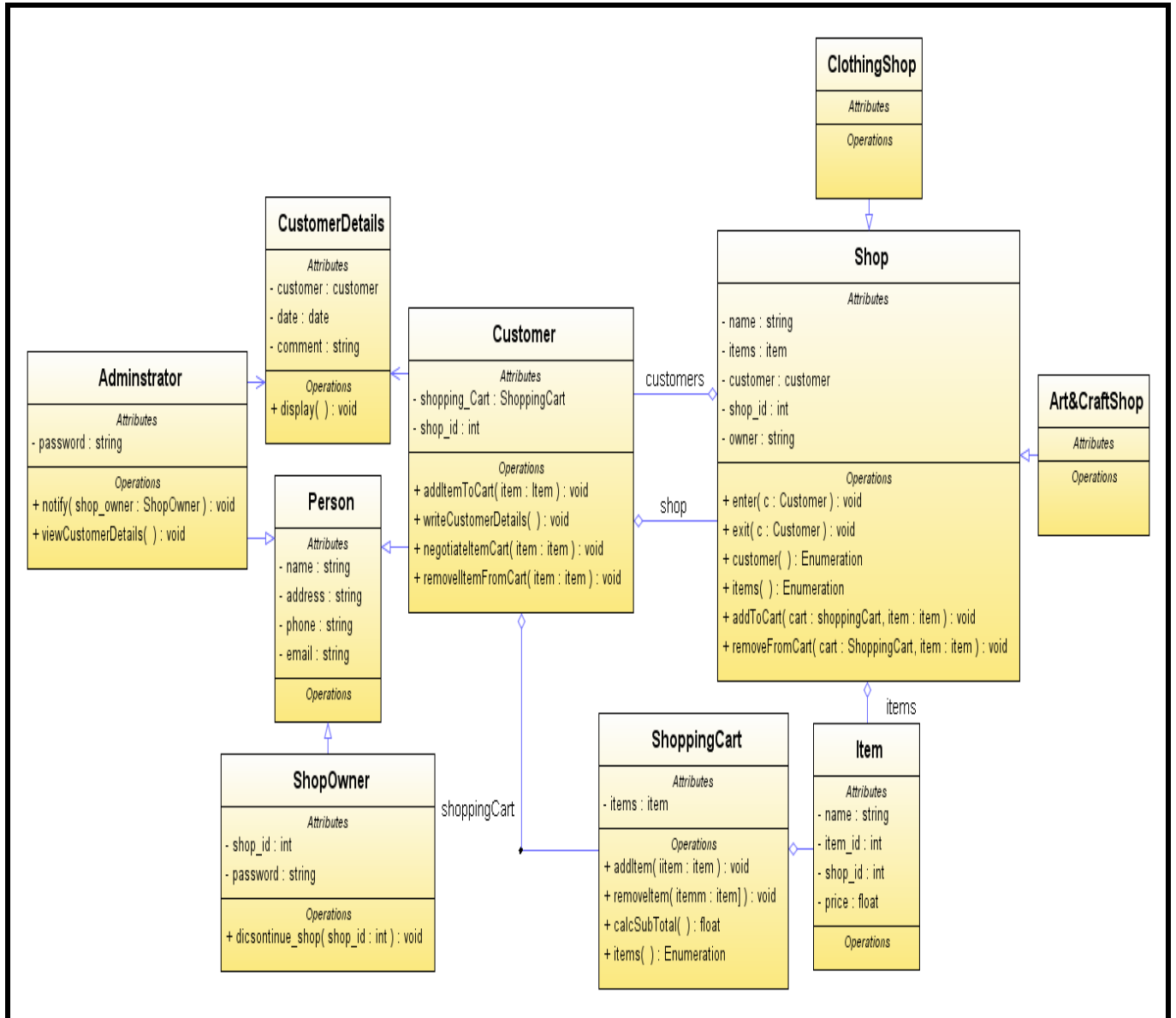


Figure DRP Class Diagram

Some of the functions of a customer on DRP application are explained in sections 5.3.1 to section 5.3.5. The given classes and methods explain the class diagram on figure 15.

5.3.1 Customer Class

- Get a list of all the available shops
- Get a shopping cart
- Offer prices to any items in the cart

Possible Methods:

- void enter(Customer c) - customer c enters DRP application
- void exit(Customer c) - customer c exits the application
- ShoppingCart getShoppingCart - returns an empty shopping cart
- Enumeration customers() - returns an enumeration of the customers in the mall
- void checkout(shoppingCart cart) - checkout and purchase items in shopping cart

5.3.2 Shop Class

Attributes:

- name - the name of the store
- storeId - unique ID for the store
- items - items available for sale in the store
- customers - the customers currently in the store
- owner – the owner of the shop

Possible Methods:

- abstract void enter(Customer c) - customer c enters the store
- abstract void exit(Customer c) - customer c exits the store
- Enumeration customers() - returns an enumeration customers in the store
- Enumeration items() - returns an enumeration for the items available
- abstract void addToCart(shopingCart, item) - add an item to shopping cart
- abstract void removeFromCart(shopingCart, item) - remove an item in cart
- The art and craft and clothing shops are possible subclass of Store

5.3.3 Item Class

Notable Attributes:

- itemName - the name of the item
- itemId - unique ID for the item
- storeId - the ID of the store from which the item came
- price - the price of the item
- points – the points allocated to the item

5.3.4 Customer in a mall class

This class extends the general person class

Notable Attributes:

- shoppingCart - the shopping cart being used by the customer
- store - the store the customer is currently in.
- ShoppingCart : A shopping cart for the customer.
- Notable Attributes:
- items - items currently in the shopping cart

Possible Methods:

- showItem() - displays a list of the items in the cart
- addItem()- adds a given item to collection
- removeItem() – removes the given item from the collection.
- calcSubTotal() – calculates the incremental total of items in the cart.

5.3.5 Shop Owner

Each shop has an owner. This class also extends the person class.

Notable Attributes:

- Password and shop_id
- Person:
- Name, email, phone and address as the attributes

The given objects, attributes and methods were given to explain the class diagram on figure 15. An analysis of these objects, their attributes and the methods enabled the development of the rewarding modules with user friendly interfaces which will be given later in this chapter.

5.4 Database Design

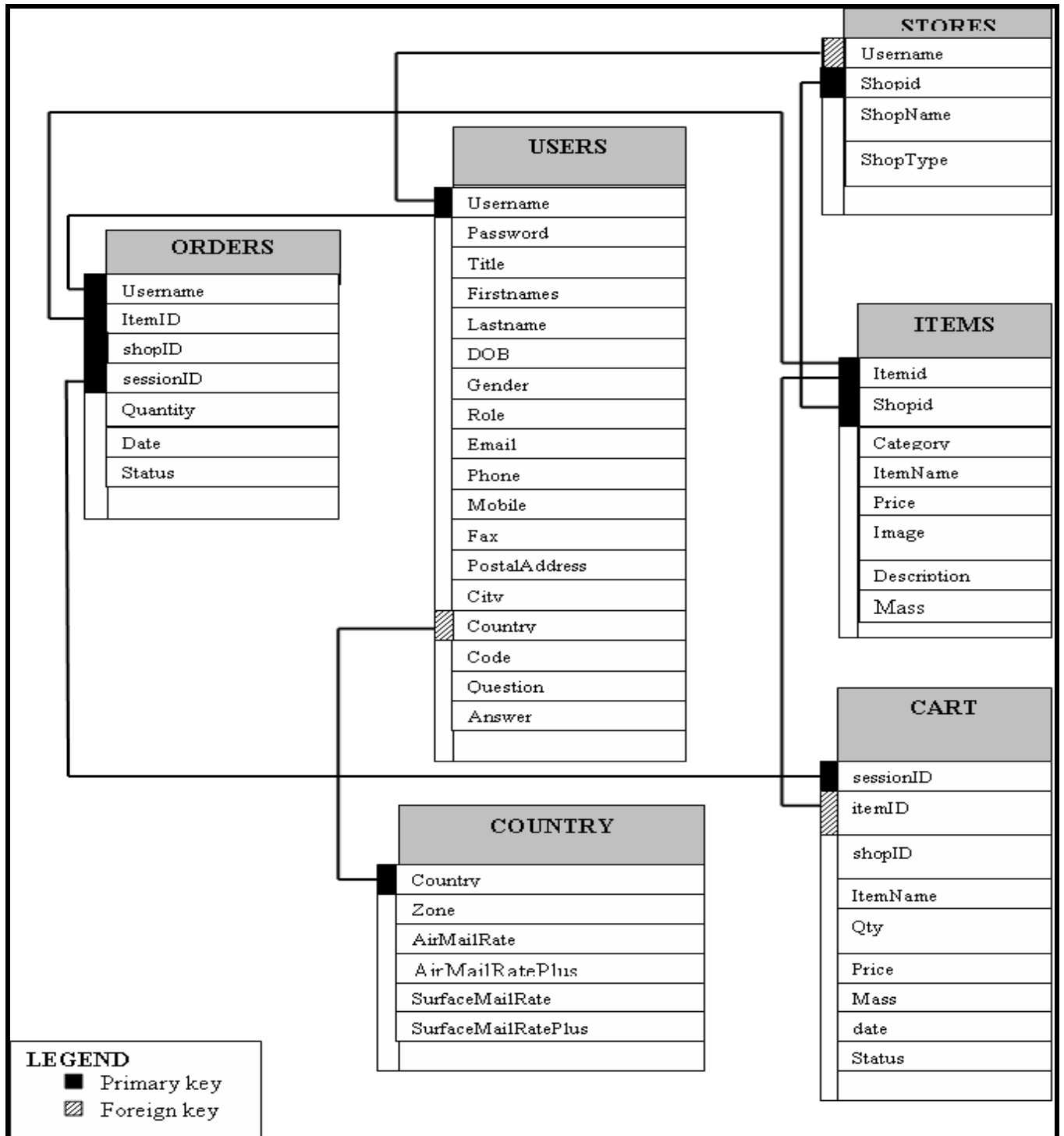


Figure Database Models
(Njenje, 2008)

The architecture diagram and the class diagram were not enough for the development of the whole DRP application. The database structure and identifying key entities of the database were also critical to comprehend prior to the actual system development.

The tables for *buy at Dwesa*, listed from table 4 to table 8 (Njenje, 2008), were maintained for the development of the DRP application. Figure 16 is the database model with the tables used for the development of *buy at Dwesa*. However, there were some alterations made to the existing tables in order to accommodate the new modules. The reason for maintaining the database tables was that as it has been indicated that this thesis explains an additional application to the existing *buy at Dwesa*, thus the alterations were done to accommodate the additional features.

5.4.1 User Information

A field to capture the customer's income level was added in the user's table. This is to allow the system to have more details regarding the customer. This field is necessary when the customer negotiates, as it assists the system to make some decisions based on this field. However, most of the user's details found in this table play an important role in the development of the rewarding modules.

Table User details

	Field	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	Username	varchar(20)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Password	varchar(20)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Title	varchar(10)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Firstnames	varchar(40)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Lastname	varchar(20)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	DOB	varchar(30)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Gender	varchar(10)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Income	varchar(10)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Role	varchar(15)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Email	varchar(30)	latin1_swedish_ci		Yes	NULL	

5.4.2 Cart Details

The cart table was also altered and new fields were added. These include the *Offer Price* and *Negotiate* fields. Offer price allows the customer to make an offer after adding items into a cart. The negotiate field allows the shop owner to select whether the item added to the cart could be negotiated. Customers can offer prices and negotiate for any item added to the cart.

Table Cart details

<input type="checkbox"/>	Field	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	sessionID	varchar(50)	latin1_swedish_ci		No		
<input type="checkbox"/>	itemID	int(11)			No	0	
<input type="checkbox"/>	shopID	int(11)			Yes	NULL	
<input type="checkbox"/>	itemName	varchar(30)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	qty	int(11)			Yes	NULL	
<input type="checkbox"/>	price	decimal(8,2)			Yes	NULL	
<input type="checkbox"/>	OfferPrice	decimal(10,0)			No	None	
<input type="checkbox"/>	Negotiate	binary(1)			No	None	
<input type="checkbox"/>	mass	decimal(8,2)			Yes	NULL	
<input type="checkbox"/>	date	varchar(20)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	status	varchar(20)	latin1_swedish_ci		Yes	NULL	

5.4.3 Points Details

A points table was added to the above tables. This table has three fields namely *id*, *Username* and *points* value. Each user should have points from registration as it has been explained in the first chapter. The points are stored in this table. The shop owner and the customers get all the points details from this table.

Table Points details

<input type="checkbox"/>	Field	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	id	int(20)			No	None	auto_increment
<input type="checkbox"/>	Username	varchar(20)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	points	int(10)			No	None	

Another important field we have added to the tables is the points field. This was added to the item table. This field allows the shop owner to insert points on items in the shops. As indicated before in this thesis, most of the items in the shops have points. Of course, there are a few items

without points. In addition to the points field cost price, offer price and negotiate fields were also added to items table.

Table Items details

	Field	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	Itemid	int(11)			No	None	auto_increment
<input type="checkbox"/>	Shopid	int(11)			Yes	NULL	
<input type="checkbox"/>	Category	varchar(20)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	ItemName	char(30)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	CostPrice	decimal(8,2)			Yes	NULL	
<input type="checkbox"/>	Price	decimal(8,2)			Yes	NULL	
<input type="checkbox"/>	Image	varchar(30)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Negotiate	tinyint(1)			Yes	NULL	
<input type="checkbox"/>	OfferPrice	decimal(8,2)			No	None	
<input type="checkbox"/>	Description	varchar(500)	latin1_swedish_ci		Yes	NULL	
<input type="checkbox"/>	Mass	decimal(8,2)			Yes	NULL	
<input type="checkbox"/>	Points	int(10)			Yes	NULL	

5.4.4 Negotiation Factors

A table that allows the shop owner and the system to activate different factors and set some negotiation rules was added. This has fields such as factors to be considered during negotiation, the status of each factor and the dates of factor modification. Each of the factors is assigned a level, for example high or low and each level has a value. These factors are added and updated by the shop owners as we have explained in Chapter 3 under the shop owner roles.

Table Negotiation factors

	Field	Type	Collation	Attributes	Null	Default	Extra
<input type="checkbox"/>	id	int(10)			No	None	auto_increment
<input type="checkbox"/>	Name	varchar(20)	latin1_swedish_ci		No	None	
<input type="checkbox"/>	highValue	int(10)			No	None	
<input type="checkbox"/>	mediumValue	int(10)			No	None	
<input type="checkbox"/>	lowValue	int(10)			No	None	
<input type="checkbox"/>	status	tinyint(2)			No	None	
<input type="checkbox"/>	date_modified	varchar(20)	latin1_swedish_ci		No	None	

An understanding of the database tables and their relationship was critical for the development of the rewarding application explained in this thesis. Since the customers will be communicating with the system, the whole engine of the negotiation explained here is based on the database.

5.5 Rewarding application development

As explained earlier in this thesis, the aim is to attract customers to buy more and be rewarded for that. It means the system should be user-friendly to customers and provide the necessary information or details, giving customers reasons to shop again. The developer, just like in the initial development of the existing shopping portal, has customers in mind. All this is aimed at attracting more customers. At the same time, having shop owners in mind who may not be very knowledgeable about computers, development of a user-friendly back-end interface was also considered in this thesis. The class diagram and the database tables explained above have enabled the development of a user-friendly rewarding application to attract customers globally for purchasing on the *buy at Dwesa* shopping portal.

5.5.1 Front end interfaces

We have designed interfaces that are visible, easy to use and informative on our shopping portal. The interfaces are user-friendly and are meant to attract many customers.

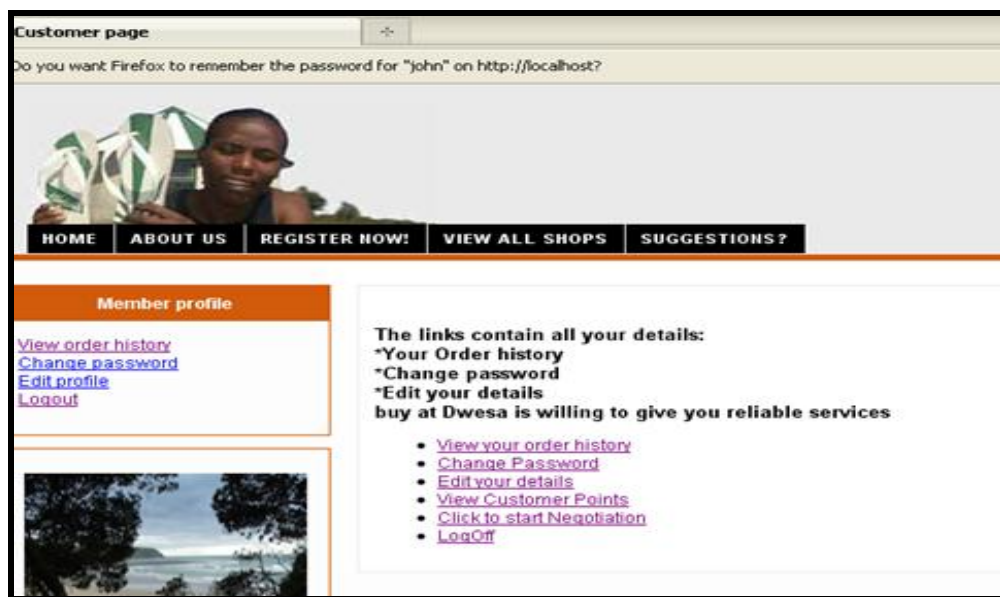


Figure Customer Interface

Figure 17 is the page that is displayed when the customer logs on to the system. Customers are able to view orders, view points and modify their details. Customers can also view all the shops and items in the shops. This allows customers to add items to the cart. Using the *view customer points* menu, a customer can see the current points available in his/her account. Figure 18 shows the customer viewing the available points when logged on.

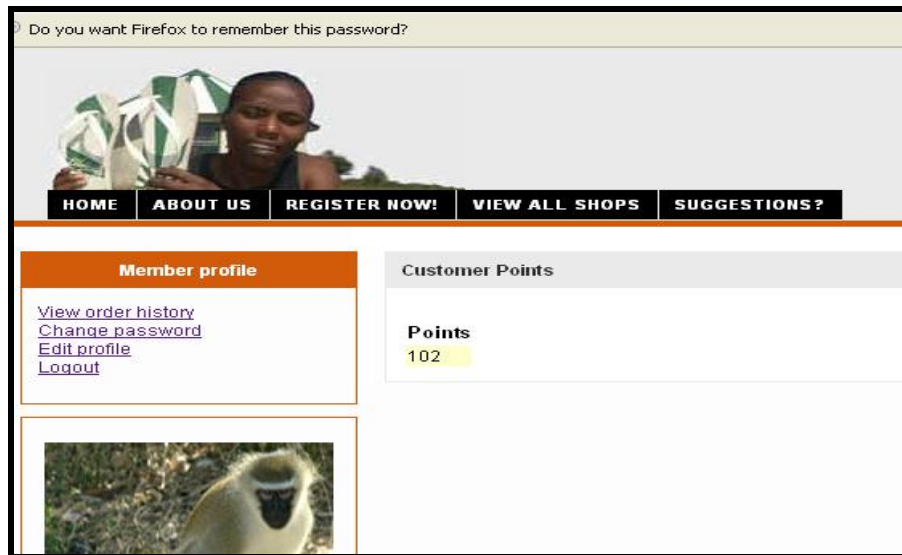


Figure Customer viewing points

After adding the intended items to their cart the following details are displayed to the customer. The customer is given an option to negotiate for the price on some of the items added to the cart. The total amount of the order and the total points for buying the items are displayed as shown in figure 19:

Item name	Price	Quantity	Update cart	Negotiate	Remove item	Points
Intsaka	€ 10.00	<input type="text" value="1"/>	<input type="button" value="Update"/>		<input type="button" value="Remove"/>	5
Inqashela	€ 2.50	<input type="text" value="1"/>	<input type="button" value="Update"/>		<input type="button" value="Remove"/>	0
Iqanda	€ 20.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>	10
Vulakabini	€ 40.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>	20
Iqhiva	€ 25.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>	12
SUBTOTAL : € 97.5						
Total Points : 47						

Figure Cart Details

The *Negotiate* option displayed in figure 19 allows the customers to begin negotiating after adding some items to their cart. The points added to the customers' points which account for buying the items added to the cart are displayed as shown above (total points 47). For some items, customers can negotiate allowing them to give some offers for the items added. However, some items are not negotiable, as already highlighted. When the customer clicks on negotiate, the offer button appears as indicated in figure 20. The offer button allows the customer to make an offer on the price displayed. The customer can make offers on the items added to their cart.

Member login		Your cart information																																	
Username <input type="text"/> Password <input type="password"/> Forgot your password? <input type="button" value="Login"/> Register now		YOUR CART CONTAINS <table border="1"> <thead> <tr> <th>Item name</th> <th>Price</th> <th>Quantity</th> <th>Update cart</th> <th>Offer Price</th> <th>Negotiate</th> <th>Remove item</th> </tr> </thead> <tbody> <tr> <td>Intsaka</td> <td>€ 10.00</td> <td><input type="text" value="1"/></td> <td><input type="button" value="Update"/></td> <td><input type="text" value="10.00"/></td> <td><input type="button" value="Negotiate"/></td> <td><input type="button" value="Remove"/></td> </tr> <tr> <td>Inqashela</td> <td>€ 2.50</td> <td><input type="text" value="1"/></td> <td><input type="button" value="Update"/></td> <td></td> <td></td> <td><input type="button" value="Remove"/></td> </tr> <tr> <td>Inanda</td> <td>€ 20.00</td> <td><input type="text" value="1"/></td> <td><input type="button" value="Update"/></td> <td><input type="text" value="20.00"/></td> <td><input type="button" value="Negotiate"/></td> <td><input type="button" value="Remove"/></td> </tr> </tbody> </table>						Item name	Price	Quantity	Update cart	Offer Price	Negotiate	Remove item	Intsaka	€ 10.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="text" value="10.00"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>	Inqashela	€ 2.50	<input type="text" value="1"/>	<input type="button" value="Update"/>			<input type="button" value="Remove"/>	Inanda	€ 20.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="text" value="20.00"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>
Item name	Price	Quantity	Update cart	Offer Price	Negotiate	Remove item																													
Intsaka	€ 10.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="text" value="10.00"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>																													
Inqashela	€ 2.50	<input type="text" value="1"/>	<input type="button" value="Update"/>			<input type="button" value="Remove"/>																													
Inanda	€ 20.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="text" value="20.00"/>	<input type="button" value="Negotiate"/>	<input type="button" value="Remove"/>																													
		SUBTOTAL IS : € 32.5																																	

Figure Customer Offers

During the negotiation process customers have the chance to offer different prices. There are different messages displayed to the customers depending on the offer price made by the customer. In cases where the customer makes an offer that is too low, a corresponding message is communicated to the customer. The messages are aimed at assisting the customers on the offers the system might accept for successful negotiation.

If the customer's offer price is too low the customer is asked to make another offer until the given number of negotiation attempts are used up. The system gives a counter-offer and the customer can accept or reject the counter-offer. By accepting the deal, the difference between the selling price and the negotiated amount has to be subtracted from the original total price of the items in the cart

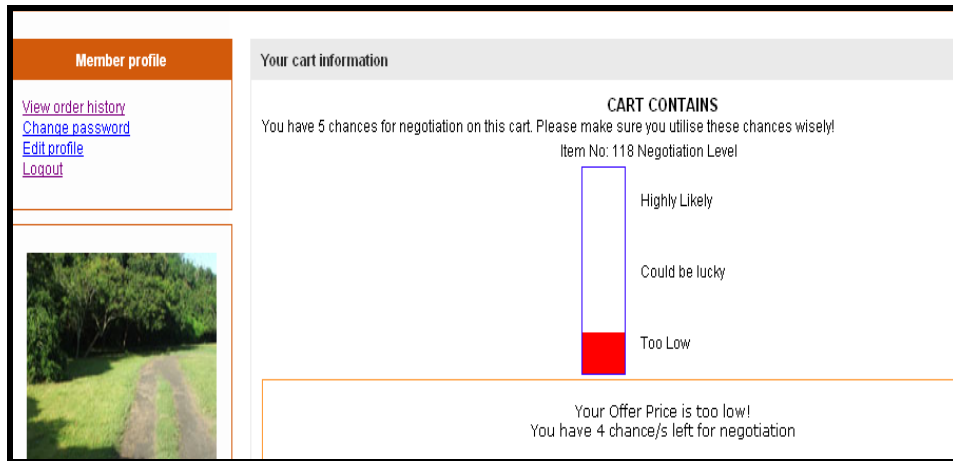


Figure Customer offer too low

Figure 21 shows the message communicated to the customer after making a low offer. Customers are limited in relation to the number of offers they are able to make, to minimize the negotiation tasks and to improve the efficiency of the system. We have used the bar graph to guide the customer when making offers during negotiation and improve customer feedback. When a customer makes a good offer acceptable to the system, a different message is displayed. The message is as displayed as show in figure 22.

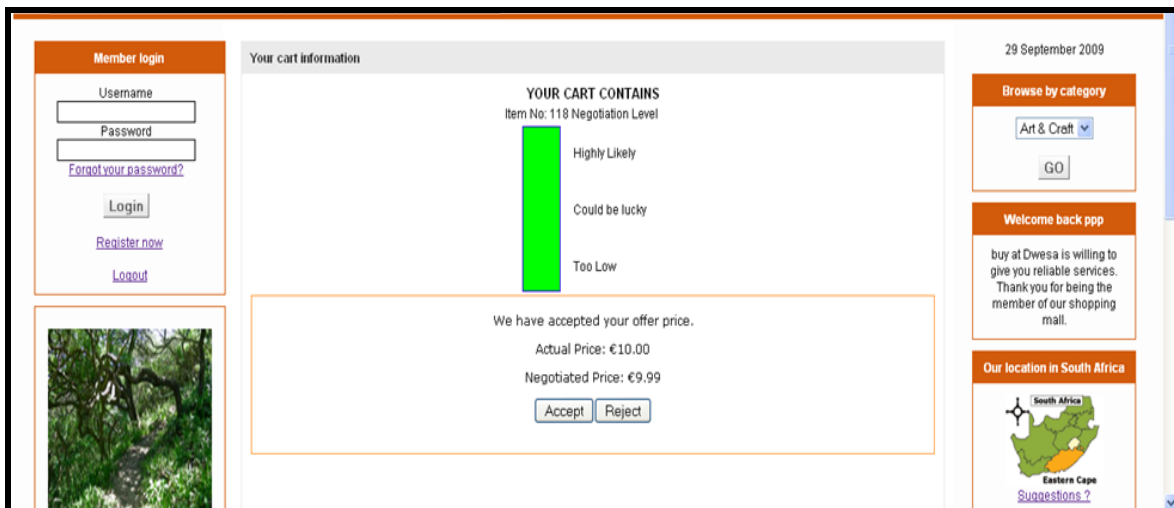


Figure Customer offer accepted

The screen shot in figure 22 shows that the system has accepted the offer made by the customer. The customers have two options, either to accept or reject the deal, after that. Choosing to accept

deducts the negotiated price from the selling price and reduces the subtotal price. Rejecting the offer allows the customer to exit the current page.

The system can send a message containing a counter-offer to the customer during the negotiation process. It should be noted that the counter-offer message is only displayed in cases where the customer's offer is above the cost price. The customer may choose to accept the counter-offer and complete the negotiation process. Rejecting the offer gives the customer a chance to make a new offer.

5.5.2 Back-end interfaces

The shop owners are responsible for the management of the rewarding modules. Of course, the administrators are available, but shop owners do most of the daily activities. In chapter three, the roles of the shop owner were explained. The system has been demonstrated to the shop owners to be able manage the system. However, it should be appreciated that the DRP application in this research is dynamic and requires constant monitoring and changes. All these factors were taken into account and we have developed user-friendly back-end interfaces.

Figure 23 summarizes the main roles performed by the shop owners. Shop owners can upload items, view all the shops and items, view all the customers' points and view all orders.

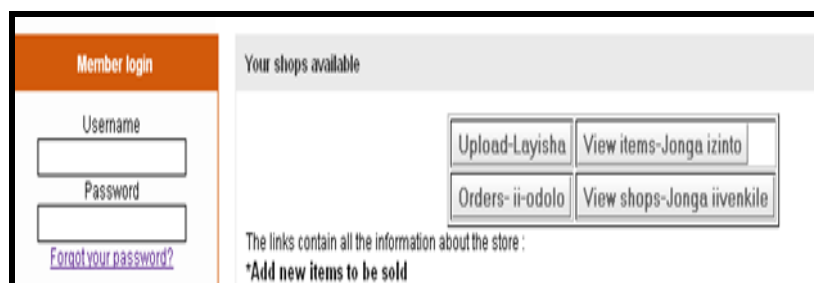


Figure Shop owner interface

Upload an item

Upload-Layisha View items-Jonga izinto
Orders- ii-odolo View shops-Jonga iivenkile

UPLOAD AN ITEM - LAYISHA INTO

Category - Uluhlu

Item Name - Igama lento

Price(R) - Ixabiso, ungafaki R ka Rands (Inani lodwa)

Item Points - Amapoints

Load image - Layisha umfanekiso

Weight in grams - Ubungakanani (Inani lodwa)

Description - Ingcaciso ngesilungu

Figure Uploading items

The screen shot given on figure 24 shows a shop owner interface to upload the items. The key field to this research is where points are assigned to an item. Shop owners have to give all the required item details. To upload the image, the browse button is used, which allows the selection of the item from any location where the item is saved.

Figure 25 shows the shop owners viewing all the customers' points. It is critical to note that it is only the administrator and the shop owners who can view all the customers' points and orders. Therefore, below is the shop owner interface to view all the points details from the database.

New user Change password Edit profile	Username Points admin 0 admin1 50 Bobby 50 eve 250 faith 50 fred 50 john 50 ngwane 0 nj 0 nobe 122 nobertj 102 nobetr 50 paul 50 ppp 150 qq 100 Richard 50 rrrr 50 Shammy 50 tom 50 tsioti 30 xxx 102
---	---

Figure Shop owner viewing points

Shop owners have a menu to update and edit the negotiation factors. As explained in chapter 4, the negotiation module consists of dynamic factors, which have to be updated frequently. Therefore, in the development of the rewarding system, we have developed a user-friendly interface for the shop owners to easily update and modify the negotiation factors. The factors can be added and some can be active whilst others cannot. When customers negotiate only active factors will be considered to give some discount.

The negotiation factors can be modified and updated at any particular time. During the negotiation process the system gets the updated values and factors from the database. Using this interface allows the shop owners to add or edit the negotiation factors. There is an option to select from the already listed factors or to type in a new factor. The factors are given different values and have different levels. The shop owners determine these levels and values.

Update factors

Upload-Layisha	View items-Jonga izinto
Orders- ii-odolo	View shops-Jonga iivenkile

UPDATE NEGOTIATION FACTORS

Select factor Select Negotiation Factor ▼

Factor Name -

Factor Level High ▼

Active

Not Active

Figure Setting negotiation factors

5.6 Conclusion

Chapter 5 has discussed how the DRP application was designed and it has shown the structure and functionality of the different user interfaces. It also gave the architecture of the rewarding modules and the database models. This chapter has explained the actual development of all the rewarding modules. The next chapter follows on this and concentrates on the implementation of these modules.

CHAPTER 6: REWARDING MODULES LOW- LEVEL IMPLEMENTATION

This chapter describes the implementation of the rewarding modules. It shows the PHP scripts we have used for the implementation of the project. The different interfaces that were implemented are also explained in this chapter.

6.1 Introduction

This chapter discusses the implementation details of the DRP application. This includes the implementation of the rewarding modules and the process of negotiation between the system and its customers. Where appropriate, source code or screen shots are used to explain how the modules were actually implemented. The same platform upon which *buy at Dwesa* is running was maintained for this project, since this thesis explains an additional application.

6.2 Client-server communication via HTTP protocol

As has been explained earlier in this study of *buy at Dwesa*, the communication process has not changed for the implementation of this project. When the server receives a client's HTTP request, the server loads the document (usually a webpage) requested by the client. The two most common HTTP requests used in this project are the GET and POST methods. These HTTP requests are used to send data to a Web Server (Njenje, 2008).

6.2.1 GET Method

Using the GET method, information from a form is added onto the end of the action Uniform Resource Locator (URL) being requested. Typically, the server's response is cached in the user's computer so that it can be revisited using the back button.

6.2.2 POST Method

A POST request adds form contents to the end of an HTTP request. An HTTP request contains information about the server, client, connection and authorization. In the POST method, the user's input is transmitted in the body of the message to the server. The response to a POST request is not cached because the next POST response may not contain the same information. Listing 1 below is an example of POST method used in this project:

```
139 <br><form method="post" action="Remove.php">
140 <?php
141 echo('<input type="hidden" name="itemid" value="'. $item. '">');
142 echo('<input type="hidden" name="shop" value="'. $shopid. '">');
143 ?>
144 <TD><input type="image" alt="Remove" src="images/remove.JPEG"></TD></form>
145 </TR>
```

Listing POST Method

The above POST example in listing 1 posts any data to *Remove.php* file (line 139). HTTP is a client-server request-reply protocol that is *stateless*. That is, the protocol does not make any association between one transaction and another, e.g., the time since the last transaction, type or client involved in the last transactions, as well as the data exchanged between the client and server. As far as HTTP is concerned, each transaction is a separate event. That is why explicit state maintenance by the DRP system itself is essential to keep track of the user's sessions.

6.2.3 State maintenance

Session tracking ties together a series of browser requests. It keeps the information on the requests made to a Web Server, which involves passing data generated from one request onward, so they can be associated with data generated from subsequent requests. PHP allows the user to store information on the server. However, this session information is temporary and usually deleted very soon after the user has left the website. When the customer visits the site for the first time, a session for that customer is created and it is used to maintain the current state. The state is maintained by setting the session value to contain a unique session identifier. The following code segment shows how to create a session for the cart and assign the session identifier to the variable *user*.

```

1  <?php session_start(); ?>
...
54 <center><b> <?php $ SESSION['user']; ?>

```

Listing Session management

To call the *user* session variable, the code is placed at the beginning of the PHP page. The session user is automatically available and can be called anywhere on the page. The session object is used to store information about, or change settings for a user session. Variables stored in the session object hold information about one single user, and are available to all pages in the shopping mall application. The server creates a new session object for each new user, and destroys the session object when the session expires. In this project, the session was used for maintaining the user's navigation through the site.

```

82 $points = 50;
83 $query="INSERT INTO users( Username, Password, Title, Firstnames, Lastname, DOB, Gender, Income, Role, Email, Phone, Mobile, Fax,
PostalAddress, City, Province, Code, Question,Answer) VALUES( '$username', '$passwordl', '$title', '$firstname', '$lastname', '$dob',
'$gender', '$income', '$role', '$email',
84 '$phone', '$mobile', '$fax', '$address', '$city', '$province', '$code', '$question', '$answer')";
85 $result = mysql_query($query)
86 or die('Error, inserting failed!');
87 $query="INSERT INTO points( Username, points ) VALUES( '$username', '$points' )" ;
88 $result = mysql_query($query)
89 or die('Error, inserting failed!');
90 ?>

```

Listing Getting customer details

All the important details regarding the customers during the registration process are captured by the code shown in listing 3. The details are stored in the respective tables and the information is used when the customer buys. The key factors we have considered for negotiation are captured from the above code upon which the points obtained by the customer can also be set. All the customer details captured are stored in the users' table during the customer registration.

```

51 <?php
52 $i=0;
53 while ($i < $num) {
54 $itemid=mysql_result($result,$i,"Itemid");
55 $shopid=mysql_result($result,$i,"Shopid");
56 $item_name=mysql_result($result,$i,"ItemName");
57 $price=mysql_result($result,$i,"Price");
58 $image=mysql_result($result,$i,"Image");
59 $description=mysql_result($result,$i,"Description");
60 $points=mysql_result($result,$i,"Points");
61 ?>

```

Listing Displaying cart items

The code in listing 4 shows the details of the items displayed when the customers view the items on the online shop. These include *itemid*, *itemname*, *price*, and the *description* of the item. The key field of this code is where the points are inserted. As already stated in previous chapters, all the items have different points and customers accrue these points when buying online.

```

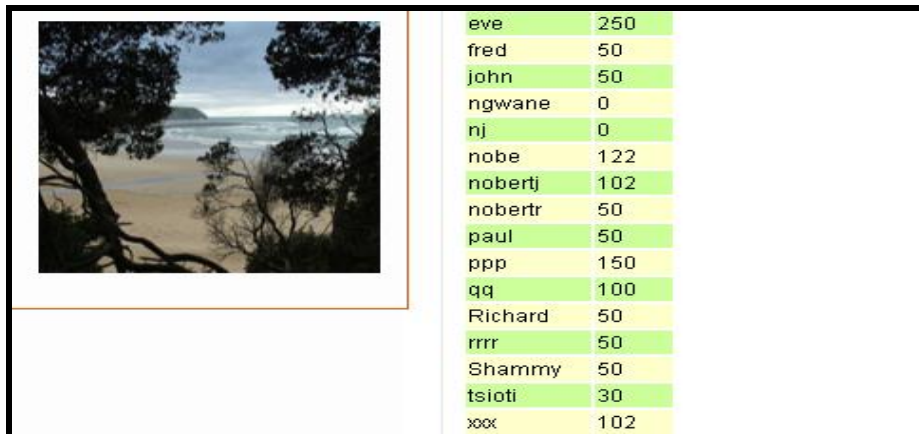
24 if(($_u == "admin") || ($_u == "ngwane")){
25     $query="SELECT Username, points FROM points ORDER BY Username";
26     $result = mysql_query($query);
27     echo "<br><table border='0'>";
28     echo "<tr><td><b>Username</b></td><td><b>Points</b></td></tr>";
29     $j=true;
30     while ($row = mysql_fetch_row($result)){
31         if($j)
32             $j=false;
33         else
34             $j=true;
35         echo "<tr>";
36         for ($i=0;$i<mysql_num_fields($result);$i++){
37             if ($j){
38                 echo "<td bgcolor='\"#CCFF99\"'>";
39             }
40             if (!$j){
41                 echo "<td bgcolor='\"#FFFCC\"'>";
42             }
43             echo "<em0>$row[$i]</em0>";
44             echo "</td>";
45         }
46     }
47     echo "</table>";
48 }else{
49     $query="SELECT points FROM points WHERE Username = '$_u'";
50     $result = mysql_query($query);
51     echo "<br><table border='0'>";
52     echo "<tr><td><b>Points</b></td></tr>";
53     $j=true;

```

Listing Viewing points

The code given in listing 5 allows the administrator and the shop owners to view customer points. The customer can only view his/her points while the administrator and the shop owner can view all the points details of the customers. The screen shot below shows a customer *nobertr*, viewing the points and it is currently showing that this customer has 50 points. This is explained from line 48 in the code in listing 5. The screen shots for viewing the points were displayed in the previous chapter.

The screen shot displayed in figure 27 shows the interface displayed to the administrator or the shop owner. All the customers available in the database can be viewed and the points for each customer can be displayed as shown from figure 27.



eve	250
fred	50
john	50
ngwane	0
nj	0
nobe	122
nobertj	102
nobertr	50
paul	50
ppp	150
qq	100
Richard	50
rrrr	50
Shammy	50
tsioti	30
xxx	102

Figure Customers Points details

```

1  <?php session_start(); ?>
2  <?php
3      include("config.php"); include("opendb.php");
4
5
6
7      $usr = new user();
8      $usr->setUsername("". $_SESSION['user']);
9      //$usr->setLocation("B");
10     //$itemid =118;
11     $itm = new item();
12     $itm->setItemId($_POST['itemid']);
13     $itm->setOffer_price($_POST['price']);
14     $itm->setCost_price($_POST['cprice']);
15     $itm->setSelling_price($_POST['sprice']);
16     $itm->setPoints($_POST['points']);
17     //$er_price($itm->setOffer_price($_POST['price']));
18
19     $neg = new Negotiation($usr, $itm);
20     $methods = array("Income", "Age", "Points", "OrderHistory");
21     $nego = $neg->negotiatePrice($methods);

```

Listing Clicking Negotiation button

The code in Listing 6 above allows the logged on customers to negotiate for prices on the items added to cart. The user's details are kept in a session and allow customers to negotiate. The items have the cost and selling prices. Clicking on *negotiate* allows the system to call the methods with negotiation factors.

```

53     private function getFactor($name)
54     {
55         $SQL = "SELECT * FROM nego_factors WHERE name='$name'";
56         $result =mysql_query($SQL);
57         $num = mysql_numrows($result);
58         if($num<=0) return false;
59         $factor = new factor();
60         $factor->setID(mysql_result($result,0,"id"));
61         $factor->setName(mysql_result($result,0,"name"));
62         $factor->setHighValue(mysql_result($result,0,"highValue"));
63         $factor->setMediumValue(mysql_result($result,0,"mediumValue"));
64         $factor->setLowValue(mysql_result($result,0,"lowValue"));
65         $factor->setStatus(mysql_result($result,0,"status"));
66         $factor->setDateModified(mysql_result($result,0,"date_modified"));
67
68         return $factor;

```

Listing Getting negotiation factors

The code shown in listing 7 gets the negotiation factors from the database and allows negotiation based on all the activated factors. It also gets the values set for each of the factors. The values for high, medium and low priorities are flexible and could be changed at any time.

```

75     private function validOfferPrice(){
76         $valid['result'] = true;
77         $valid['price'] = $this->item->getSelling_price();
78         if($this->item->getOffer_price() < $this->item->getCost_price())
79             {
80                 $valid['result'] = false;
81                 $valid['per'] = round(($this->item->getOffer_price()/ $this->item->getSelling_price()*100);
82                 $valid['message'] = "Your Offer Price is too low, chana!";
83                 return $valid;
84             }
85     }
86
87     return $valid;
88 }

```

Listing Offer validation

Listing 8 shows the code that compares the offer price proposed by the customer with the cost and selling price details of any item. It checks whether the offer is reasonable or not. Different messages are communicated to the customer based on the offers made. For instance for any offer that is less than the cost price, the message is “Your offer is too low”. This code returns a valid offer.



Figure Number of attempts left for negotiation

The message in figure 28 is displayed when the customer offers a price that is too low. It means the price offered is less than the cost price of the item and thus cannot be accepted. In this case, the customer is offering to pay 100 euro for an item sold at 1000 euro. From the above interface, we have added the message that is sent to the customer to include the chances available for the customer to make offers. For instance, the customer initially had 5 chances to make an offer and the interface shows that there are 3 chances left for this customer. In cases where the customer offers a price acceptable to the system a different message is displayed as shown in figure 29:

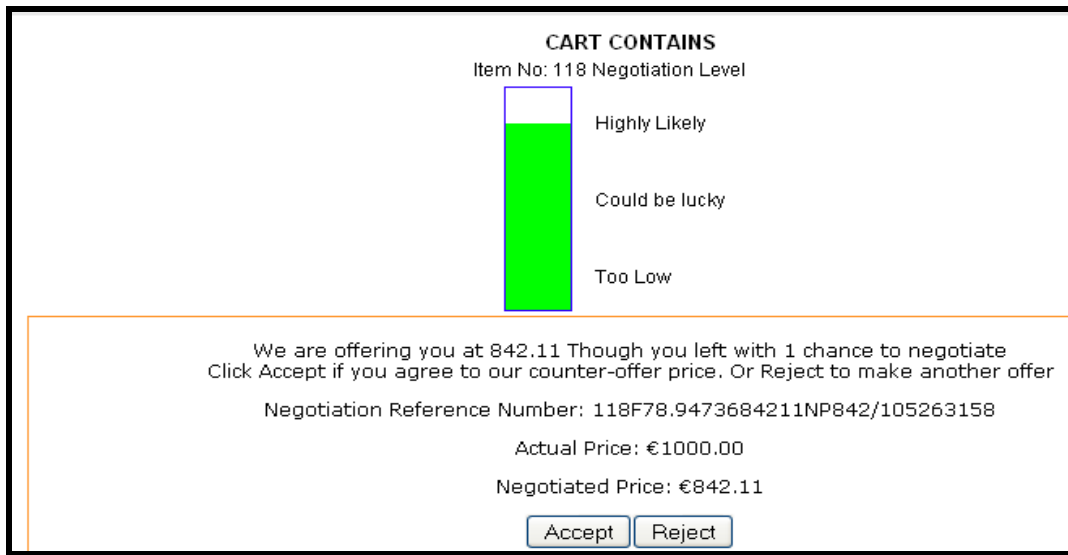


Figure System counter-offer

From the screen shot in figure 29, the customer has offered 840 euro for any item sold at the price of 1000 euro. In this case, the offer price is greater than the cost price. Again, we have generated another important message to the customer, to counter-offer the customer price. For example, the system is offering 842.11 euro for this item.


```

147     private function levelOfThermo()
148     {
149         $offer = $this->item->getOffer_price();
150         $cost = $this->item->getSelling_price();
151
152         $level = round(($offer/$cost) * 100);
153         if($level>100)
154         {
155             $level = 100;
156         }
157
158         $result = $level; //round off this figure!!!
159
160         return $result;
161     }

```

Listing The shaded bar displayed when validating offers

The sample code in listing 9 computes the value in percentage on the level, which should be shaded on the informative graph that is displayed to the customer during negotiation. This is where the level of the graph to be shaded is determined.

```

392     private function runFactors(array $type)
393     {
394         $num = 0;
395         $per = array();
396         foreach($type as $t)
397         {
398             $method = "by{$t}";
399             $factor = $this->getFactor($t);
400             if($factor->getStatus()==1){ //enabled factors
401                 if(method_exists($this, $method))
402                 {
403                     $per[$num] = call_user_method($method, $this);
404                     $num = $num + 1;
405                 }
406             }

```

Listing Processing Negotiation factors

The code displayed in listing 10 runs all the activated negotiation factors.

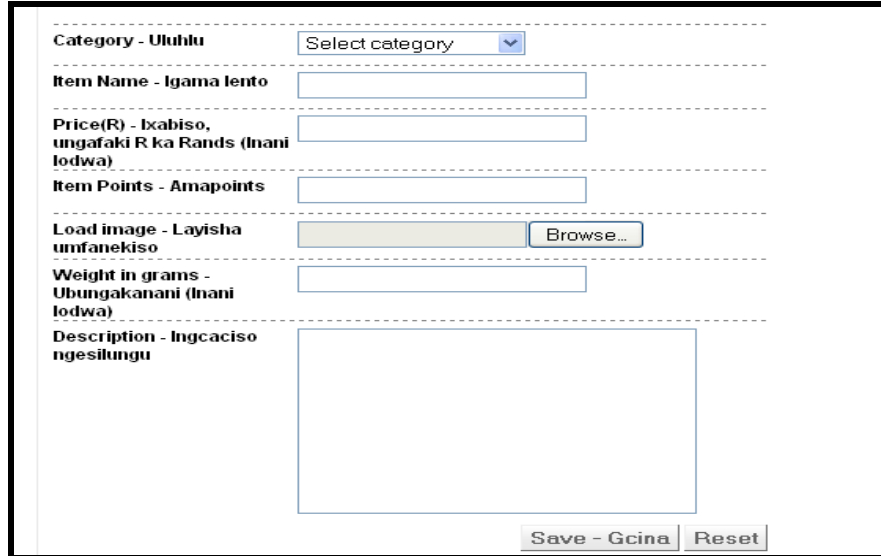
6.3 Back-end implementation

The code shown in listing 11 allows the shop owners to upload new items. The shop owners have to capture all the unique features of each item. This should be done accurately so that when customers choose to negotiate all the details on the items are correct. After entering the item details the shop owner should save all the details.

```
53     $category=$_POST['category'];
54     $name=$_POST['name'];
55     $price=$_POST['price'];
56     $description=$_POST['description'];
57     $points=$_POST['points'];
58     $extension = pathinfo($_FILES['uploadfile']['name']);
59     $extension = $extension[extension];
```

Listing Uploading an item

The screen shot in figure 30 shows the shop owner interface for uploading an item in the shop. The code in listing 11 shows part of some lines that allows this interface below.



The screenshot shows a web form for uploading an item. The form is organized into several sections, each with a label and a corresponding input field or button:

- Category - Uluhlu:** A dropdown menu with the text "Select category" and a downward arrow.
- Item Name - Igama lento:** A text input field.
- Price(R) - Ixabiso, ungafaki R ka Rands (Inani lodwa):** A text input field.
- Item Points - Amapoints:** A text input field.
- Load image - Layisha umfanekiso:** A text input field followed by a "Browse..." button.
- Weight in grams - Ubungakanani (Inani lodwa):** A text input field.
- Description - Ingcaciso ngesilungu:** A large text area for entering the item's description.

At the bottom right of the form, there are two buttons: "Save - Gcina" and "Reset".

Figure Uploading items

The interface in figure 31 allows shop owners to edit the item details. This is to improve the efficiency of the system when shop owners have to edit details like prices and points. Points on the items can be changed at any time should shop owners wish to edit the items details. The shop owners can make any changes to the items already in the database using the edit item function.

Figure Editing items

The code displayed in listing 12 allows shop owners to set the negotiation factors. The negotiation chapter and its preceding chapters have explained how these negotiation factors were determined. This is the code that allows the shop owner to modify or set any negotiation factor.

```

51 <label for="user">Select factor </label>
52 <select name ="category">
53   <option>Select Negotiation Factor</option>
54   <option value="Age" selected="selected">Age</option>
55   <option value="Income">Income</option>
56   <option value="Points">Points</option>
57   <option value="Order History">Order History</option>
58   <option value="Time">Time</option>
59   <option value="Location">Location</option>
60 </select>
61 </p>
62
63   <p>
64 <label for="user">Factor Name - </label>
65 <input type="text" id="user" name="name" />

```

Listing Selecting factors

The screen shot for the code in listing 12 is as shown in figure 32. The shop owner can select the negotiation factor, and then chooses the priority for each factor. The factors can be either active or not active. Again, the shop owner can set the status when determining the negotiation factors.

The screenshot shows a web form with the following elements:

- A label "Select factor" followed by a dropdown menu showing "Age" as the selected option.
- A label "Factor Name -" followed by an empty text input field.
- A label "Factor Level" followed by a dropdown menu showing "High" as the selected option.
- Two radio buttons: "Active" (which is selected) and "Not Active".
- At the bottom right, there are two buttons: "Save - Gcina" and "Reset".

Figure Updating negotiation factors

The shop owner is responsible for the initial stages of making a sale of items from all the shops. Shop owners manage all the interfaces that the customers browse through. However, for this thesis the implementation of the negotiation module was the main component. Explained below are the scripts of codes for the implementation of the negotiation module. There is a class called negotiation we have explained from the code in listing 13:

```

14 session_start();
15 class negotiation {
16     //put your code here
17     private $item = "";
18     private $user;
19     private $high_level = array();
20
21     public function negotiation($user,$item)
22     {
23         $this->user =$user;
24         $this->item = $item;
25         $this->high_level = array("order"=>70,"Income"=>20, "Age"=>70, "Points"=>28);
26     }
27
28     private function getUser()
29     {
30         $SQL = "SELECT * FROM users WHERE Username='{ $this->user->getUsername()}'";
31         //echo("passing...");
32         //exit;
33         $result =mysql_query($SQL);

```

Listing Negotiation process

When the customer logs on, all the activities are kept in a session. The class negotiation has to get the item and user details. These two objects are used for negotiation as the system has to consider the item information and the user details as provided on the database. The function *getUser* extracts all the customer details from the table *users* available in the database.

```

53     }
54     private function getFactor($name)
55     {
56         $SQL = "SELECT * FROM nego_factors WHERE name='$name'";

```

Listing Getting activated factors

The code in listing 14 gets all the activated factors from the *nego_factors* table. The function *run factors* is called when the customer negotiates. The offer made by the customers have to be validated system calculates the possible prices for each customer based on the active negotiation factors and the individual customer details. Listing 15 shows part of the code which does the validation of customers' offers.

```

76     public function negotiatePrice(array $type)
77     {
78         $per_final = 0;
79         $high_poss_val = 0;
80         $this->item = $this->getItem();
81         //var_dump($this->getItem());
82         $result = $this->validOfferPrice();

```

Listing Validating offers

```

113         $per_final = ($per_final/$high_poss_val) * 100;
114         $final_price = $this->item->getCost_price() + ($diff - ($diff * $per_final/100));
115         $_SESSION['price']=$final_price;

```

Listing Calculation of final price

The code in listing 16 shows the function that is called when a customer makes offers. It checks the negotiated price. The variables *per_final* and *high_poss_val* determines the value of discount to be given to the customer during negotiation. The variable *high_poss_val* computes the value of all the factors which are in the database and calculates the percentage to deduct when the customer initiates negotiation. The formula given in line 114 of listing 16 is used to calculate the final price, which is accepted if a customer proposes it as an offer. The variable *diff* is the difference between the cost price and the selling price. The formula allows the acceptable offer price to be between the cost and selling price. The negotiation rule explained in chapter 4 comes into effect i.e. no items are sold below cost price. The session price keeps the final price the system is offering as a counter-offer to the customer. This price is communicated to the customer during the negotiation process.

Sessions were also used to keep track of each user's details. There is a session used to track the number of times the customer has negotiated for the items in the cart. There is a limit on the number of offers customers can negotiate, thus a session is used to count the number of offers made.

```

128     $_SESSION['count']=$_SESSION['count']-1;
129     $count=$_SESSION['count'];
130     if($count!=1){
131         $result['message'] = "Your offer is low, make another offer<br>You have ".$count."chances left for negotiation";
132         //.$diff." ".$per_final." ".$final_price." ".$this->item->getCost_price()." ".$this->item->getSelling_price();
133     }else{
134         $result['message'] ="We are offering you at ".$_SESSION['price'];

```

Listing Counting of No. of attempts left for negotiation

Listing 17 explains the session keeping count on the number of offers made by the customer. There is a session variable called *price* that tracks the price that could be acceptable. It tracks the realistic price that an item could be negotiated to and communicates this price from the session to the customer as a counter-offer.

6.4 System security

Once communication to the DRP application has been established, there are security aspects to consider, ensuring the privacy and authenticity of the information on the system. Most of the security issues were considered during the implementation of *buy at Dwesa*. However, there are also security issues specifically considered for this project. For the implementation of this project security measures were put up to allow each customer to get a reward or discount based on individual details.

6.4.1 User interaction

When a new user registers, there are requirements that the user should meet in order to be a member of the system. Firstly, the user needs to have a unique username. The username chosen by the registering user is searched on the database, to ensure there is no duplication. The code segment in Listing 18 shows how the username given by the user is compared to the ones available.

```
64 else {
65
66     $query1="SELECT Username FROM users where Username='{$username}'";
67     $usertest=mysql_query($query1);
68     $num=mysql_numrows($usertest);
69     if($num >0) $found=true; else $found=false;
70
71     if($found==True) {?>
72         <p align="center"><font color="black">The Username is being used by someone else</font></p>
73     <p align="center"><font color="black">Register again and try to use different Username</font></p>
74     <center><form><input type=button value="Back" class="formbutton" onClick="history.back()">
75     </form><center></center>'};
```

Listing Validation of username during registration

Thus, the logged on customer has to negotiate for the prices. Using the username allows user to negotiate and the negotiating customer details are used to calculate the discount.

6.4.2 Authentication of the user

Users have different privileges on the system, so authentication through the use of username and password is required. The role of the user is given during the registration process. As part of the

security, only the administrator is responsible for registering the shop owners and administrators, while the customers register themselves on the system. After a successful registration, the user is given a role stating the privileges that the user can partake in the system. The following code segment shows how the authentication is handled based on the user role. The following code in listing 19 opens the PHP page corresponding to the role of the user that has logged on to the system.

```
34     $query1="SELECT Role FROM users where Username='$username' ";
35     $User=mysql_query($query1);
36     $UserRole=mysql_result($User,0,"Role");
37
38     $_SESSION['role'] = $UserRole;
39
40     if( $UserRole=='Customer' ){ ?>
41     <script language="javascript">
42     window.location = 'Customer.php';
43     </script>
44     <?php }
45     elseif( $UserRole=='seller' ){ ?>
46     <script language="javascript">
47     window.location = 'Seller.php';
48     </script>
49     <?php }
50     elseif( $UserRole=='administrator' ) { ?>
51     <script language="javascript">
52     window.location = 'Administrator.php';
53     </script>
54     <?php }
```

Listing Selecting user role

The role of the user is retrieved from the users table. There are three types of users: the administrator, sellers and customers. A “session role” is used to differentiate the roles of different users. Once the user has successfully logged on, the session *role* is created. Therefore, any type of user will perform functionalities based on his/her role. All the shopping mall roles have PHP files that prevent unauthorized access.

6.4.3 Negotiation Security

During the negotiation process, only the logged on customer can negotiate. This means the username and password are used as secret credentials for any customer to start negotiation. In addition to this we have a negotiation reference number generated after negotiation. This number allows the shop owners to keep track of the negotiated items. This number has the item number, amount agreed after negotiation and the date of the negotiation. It is displayed after successful negotiation.

6.5 Conclusion

This chapter has explained the implementation of the major components of the DRP system. It has described how the different interfaces were implemented for both the users and the system administrators. As part of the implementation, we have also considered the security measures adopted by the system. The next chapter gives the different tests which were done on the system and the evaluations made.

CHAPTER 7: SYSTEM TESTING, EXPERIMENTATION AND EVALUATION

This chapter summarizes the test methods used and results obtained during the testing of the system. System usability and performance were the different tests done. Highlights of the results from the users of the system are given in this chapter.

7.1 Introduction

Before the system is deployed, a test run of the system was done to remove all the bugs. This is an important phase for a successful system. The system was demonstrated to the two main different user groups. These are the customers and the shop owners. The purpose of involving the users was to enable us to get feed-back on the usability of the system. The outputs of the test run were important to match with the expected results stated in Chapter 1. Tests on the system were also done to check on the performance of the system.

7.2 Testing of the system

Testing was carried out at two levels: Unit Testing and System testing

7.2.1 Unit test

Each of the system modules was treated as a separate unit. The different units were tested to eliminate some errors. This test was done before the whole system was tested. Unit testing allows the integration of the different modules without errors. Any undesirable activity must be noted and debugged (error corrections). All three modules of the DRP were tested. There are several common errors which were noticed during the development of the system. While we will not discuss those errors in detail, one of the common errors is given below:

```
Parse error: parse error in C:\xampp\htdocs\emal\ecommerce\negotiation\classes\negotiation.php on line 116
```

This type of error was brought to attention as it affects the running of the system. For example the above error was displayed when the user has added items to the cart and is about to negotiate.

It means the negotiation process cannot proceed. Thus unit tests were meant to correct such errors and fix all these errors to avoid problems in running the system.

7.2.2 Usability Testing

This involved the testing of all the modules of the system. The whole system was demonstrated to the different system users. At this stage the test were done on actual data. At each stage of the execution, the results or output of the system were analyzed. During the result analysis, at times it was found that the outputs were not matching the expected results of the system. In such cases, the errors in the particular programs were identified, fixed and further tested for the expected output.

When it was noted that the system was running error-free, the users were called with their own actual data so that the system could be shown running as per their requirements. The main users of the system are the customers and the shop owners. Each of the customers entered their own data and details to test the system

Usability testing involves finding out whether the system meets its intended purpose. All other testing techniques and methods done were aimed at making usability successful. According to IRM (1994), usability is the extent to which the intended user can meet his or her goals using the system being tested. To effectively test on the usability system demonstrations were done to the customers and the shop owners.

7.2.3 Usability System testing to the shop owners

Shop owners in this thesis are the producers and the sellers of the products. These are the people responsible for the management of the shops and uploading of all the items in the shops. System demonstrations were done to check if the shop owners are able to use the system. The different views of these people were captured from the questionnaires and the sample of the questionnaire is given on the Appendix C

7.2.3.1 Field evaluation of the project

The evaluation of the DRP system was based on the usability, flexibility and performance of the system. The field test evaluation of the system was initially based on training the Dwesa art and craft groups on how to use the system as required to achieve the project objectives. Our DRP system is a prototype system that was developed through an iterative process based on

comprehensive field testing in Dwesa. The system underwent an evaluation that focused on its user friendliness and flexibility. The seller's interface is designed in two languages; English and isiXhosa. This made the system understandable to the small entrepreneurs in rural communities. The art and craft entrepreneurs were trained on how to login and use the system. Login credentials were created for them to upload items to be sold. The entrepreneurs were also successfully trained on how to check orders, change their login password and edit personal details. How to assign points to the items and how to edit the items was also demonstrated to them. In addition to this, the sellers were trained in updating the negotiation factors. The negotiation rules were also explained to the sellers.

7.2.2.2 Observations made

After each training session, the feedback from the participants was collected. Most of the art and craft participants felt that the content of the training was useful. More than half of the participants believed that the time of the training was sufficient. On the other hand, some participants instead commented that there was not enough time for practicing what they had learnt. Overall, they agreed that they gained knowledge on how to use the system. Most of the art and craft members were between the ages of 35 and 65 years. This necessitated patience and more attention when introducing the system to them and also during the training session, since the members needed more time to understand. Again, considering the intelligence and rules used for negotiation, more time was allocated on this module to explain to the sellers the negotiation rules. When they were asked to rate the importance of the training by choosing a number between 1 to 10, with 1 being the lowest and 10 being the highest, the majority has rated it between 6 and 10. They found the system user-friendly and easy to use, due to the fact that their interface is written in their traditional language (isiXhosa). For this research, since it was building up from the current *buy at Dwesa*, it was not difficult for us to localize the seller interface to isiXhosa. This was so because the author of *buy at Dwesa* was good in isiXhosa and some of the interfaces were already in isiXhosa. However, during our testing of the system there was one interface that allows sellers to update the negotiation factors which was only in English. The sellers needed more time to understand this. Of course, it was easy for the sellers to update, upload and edit the details of the items in the shops since these interfaces are in two languages.

7.2.2.3 Results attained

The preliminary results from this project indicate that DRP shopping portal is easy to use, with a good demonstration of its ability to effectively market products. The system provides affordable access to technology and might help small entrepreneurs to access the global market. The shop owners were pleased and wished that the project could be deployed and used as early as possible. They were ready to start updating the negotiation factors and they indicated that the factors should be changed at any time. The following is a sample of the results from the shop owners on the negotiation factors that they mentioned as the key factors for negotiation.

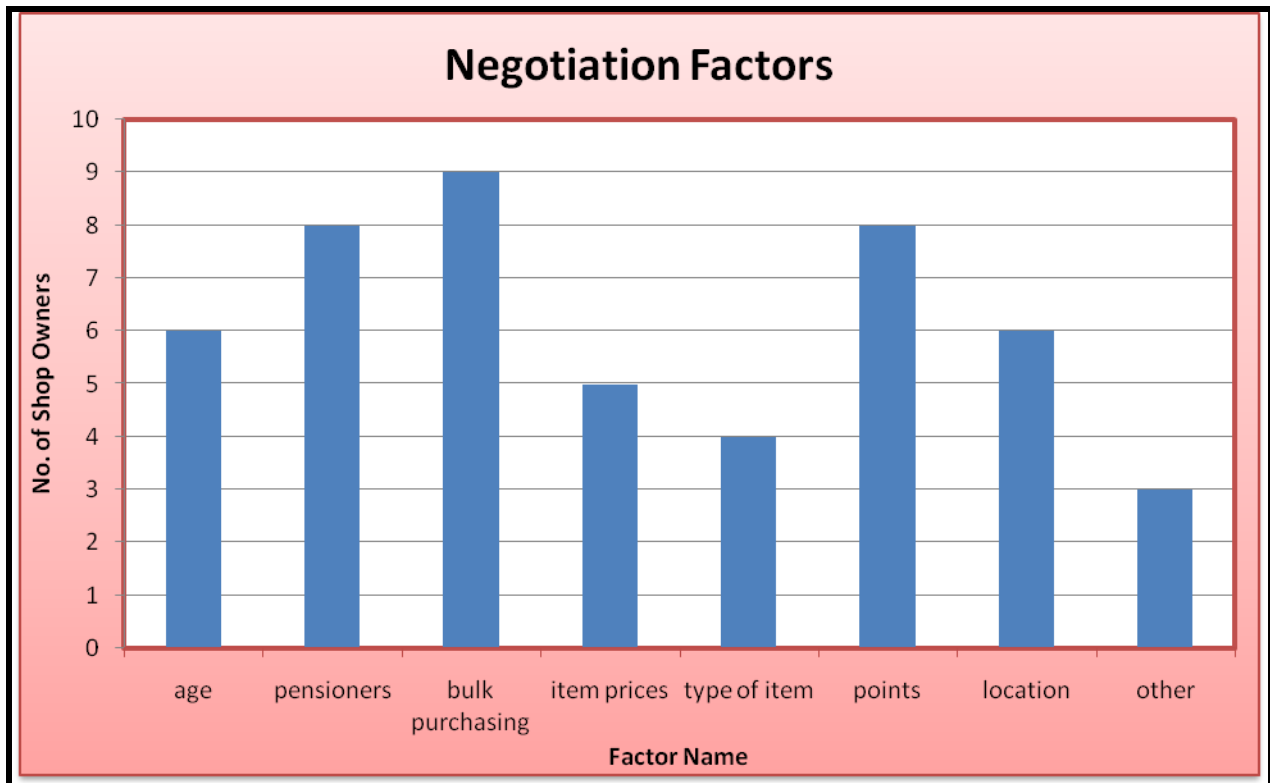


Figure Negotiation factor rating

Figure 33 above was as a result of the demonstration of the system to the shop owners and their training. These are the factors that the shop owners felt are necessary for the negotiation. We understand that most of the factors were considered for the system development, but during testing we gave sellers an opportunity to give their views on the negotiation factors. Understanding of these factors helps sellers to choose and update the negotiation factors. These results indicated that when the sellers are updating the negotiation factors, bulk purchasing and pensioners have more values. Thus, the majority of sellers prefer giving more rewards to

customers buying in bulk. However, according to the sellers they define bulk buying when someone buys large quantities of the same item.

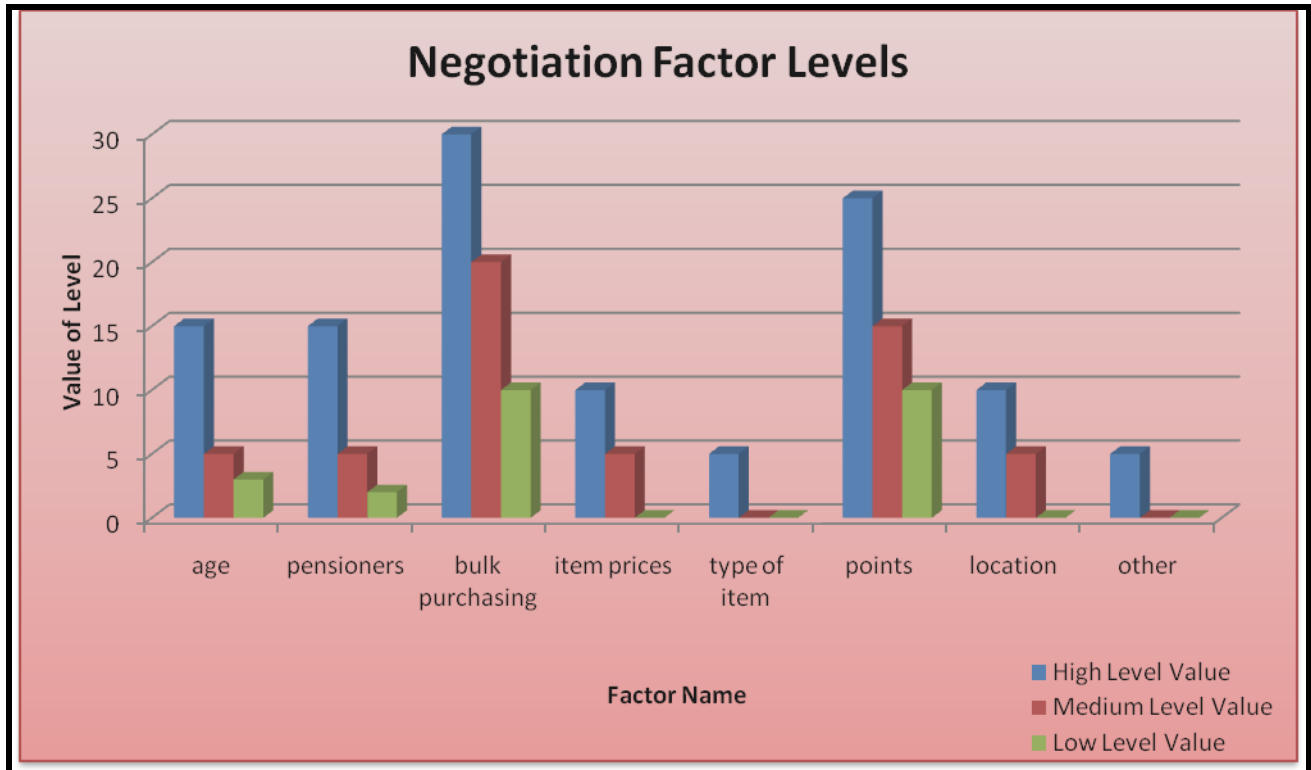


Figure Negotiation factor levels

Figure 34 shows results on the negotiation factors and their ratings during negotiation. As explained earlier, when setting the negotiation factor to be considered for negotiation, there is a need to determine the level for each factor and the value of each of the levels. From the graph it is clear that the results show that bulk purchasing has the highest value for all the level followed by the *points* factor. This means that as long as you have made some purchases even though they may be low, the customer has a chance of getting a certain discount during negotiation. Again, as long as a customer has some points even if they may be low, this customer gets a certain discount during negotiation. These values are dynamic and the shop owners can update them at any time.

The results above were extracted from the questionnaire we designed for the system training and testing. The sample of the questionnaire is attached in the Appendix B.

7.2.4 Usability system to the customers

The customers are the different people all over the world who are buying online on *buy at Dwesa*. These are the ones whom the system is aiming to attract. Thus, the system was demonstrated to a number of people to get their views on the usability of the system. Customers' preferred negotiation factors are given in the following graph.

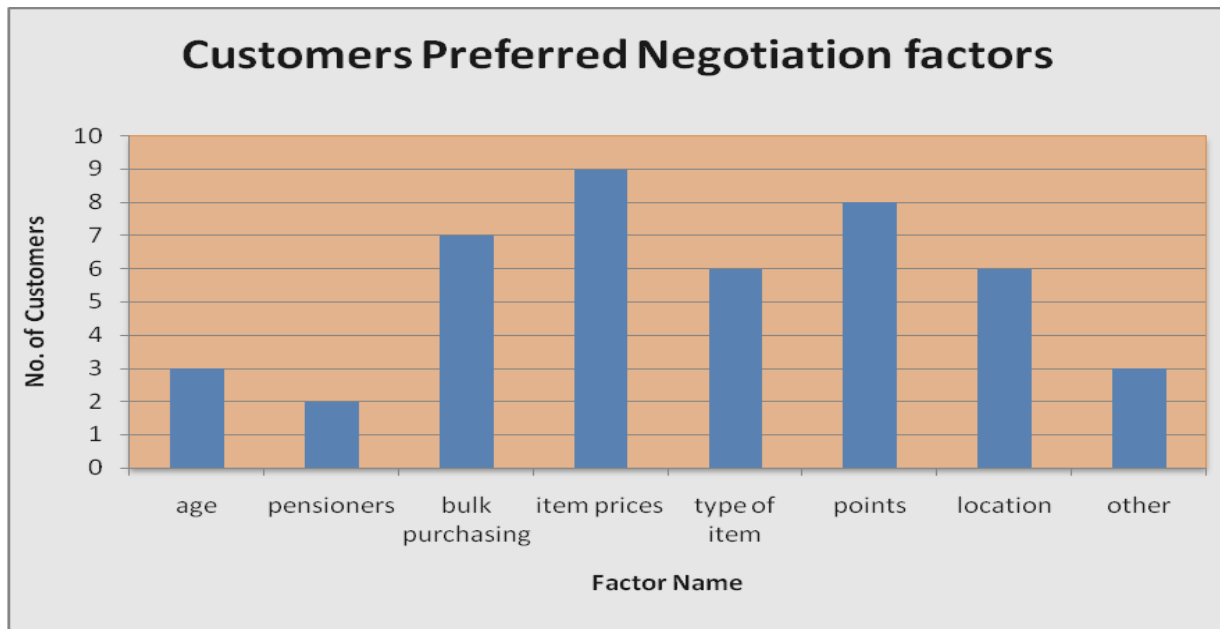


Figure Negotiation Factors for customers

The interviewed customers preferred the price of the item to be the most critical factor to be considered for negotiation. Of the 11 interviewed customers 9 of them chose this factor. This is probably because customers always prefer to pay less. However, the second highest number was on points. About 8 customers were of the opinion that the best way to be rewarded is to consider individual points. They were aware that customers with high points values are more loyal than those with less points. Another big number of customers were going for bulk purchasing as a key factor. The graph above was developed from the customers' information we obtained through the demonstrations and responses from the questionnaires. A sample of the customers' questionnaire is shown in Appendix C.

7.2.4.1 Experimental results

The details in table 9 were extracted from the database to show the negotiation factors which are set in the database. These factors were all activated and upon initiation of the negotiation process, all of them are considered.

Table Active negotiation factors

id	Name	highValue	mediumValue	lowValue	status	date_modified
1	points	30	20	5	1	17/10/2009
2	age	15	10	5	1	17/10/2009
3	income	20	10	0	1	2009-11-18
4	orderhistory	30	20	10	1	2009-11-18

However, the factors may differ from one customer to the next. This experimental test was done to see the amounts paid by two different customers who are negotiating for the same item with the same price. The two users' details are as given below:

Table Users' Negotiation details

Name	Surname	Date of Birth	Sex	Income
Paul	jere	\\"1928\\" 1 \\"1\\"	Male	<2000
John	john	\\"1989\\" 1 \\"1\\"	Male	>5000

Paul and John have 60 and 80 points respectively.

The screen shot in table 10 shows the details of two different customers, John and Paul. We did the experiment to get the results on how the negotiation process works for two different customers negotiating at the same time. We took note of the time taken for each user to complete the negotiation and the amount paid by the customers. The key details from the users' information are the age, number of points, level of income and order history. These customers have different details, which the system considers separately during negotiation. In this case, Paul is 81 and John is 20. On the number of points though, there is a difference of 20 points between the two, but these are under the same level which is the medium level. Paul has less

income and gets a higher value than John who has 0 value for income. Summarizing the actual table that is to be used to calculate the acceptable offer price for the two customers, we have designed the following table:

Table Customer Negotiation Traits

Customer	Points	Age	Income	Order History	Total value deducted
Paul	20	15	20	10	65
John	20	10	0	10	40

Table 13 shows that Paul has to get a 65% discount during the negotiation. John gets 40%. These percentages of discount are calculated from the valid and acceptable offers which the system computes. The actual negotiated prices are calculated from the formulas we explained in Chapter 4.

Actual Price: €1000.00
Negotiated Price: €863.16

Accept Reject

Item name	Price	Quantity	Update cart	Offer Price	Negotiate
Intsaka	€ 1000.00	1	Update	863.00	Negotiate

Figure Negotiation results (a)

Paul' results after negotiation. Paul made 4 different offers and the negotiated price was 863.16. The time taken to complete the negotiation process was 1 minute, 57 seconds

For John:

Actual Price: €1000.00					
Negotiated Price: €915.79					
<input type="button" value="Accept"/> <input type="button" value="Reject"/>					
Item name	Price	Quantity	Update cart	Offer Price	Negotiate
Intsaka	€ 1000.00	<input type="text" value="1"/>	<input type="button" value="Update"/>	<input type="text" value="900.00"/>	<input type="button" value="Negotiate"/>

Figure Negotiation factors (b)

John was offering the same amount for the item. We wanted to see the counter-offer, which the system sends back to the two customers during negotiation. Therefore, based on their different values for the same factors we noticed the counter-offer prices from the system. John took 1 minute, 33 seconds to complete the negotiation process. The time was set from the start of the negotiation to the end, i.e. from the moment when the user clicks the negotiate button to the final stage where the user accepts the final price. The differences in time show that for a user matching all the activated factors it takes a bit longer to calculate the final price. These results help to explain what different customers end up paying for after negotiating with the system. The differences in the offers acceptable is determined by the customers' details and buying behaviour. The results explain some of the customer tests we carried out during the system test.

7.2.4.2 Other Customer views

Customers were wondering how the system computes the offers. Most of the customers about 9 from those interviewed were willing to know how the offers are validated. They wanted to get the reasons why customers buy at the different prices. Customers wanted to know how the negotiation process works. Of course, the interviewed customers were lucky to be advised on how the negotiation process works. The system considers all the activated negotiation factors. However, since the system is developed for business purposes, how the whole negotiation process works is business secrecy. The customers should not be notified on how the system reaches at a certain price. This is why only the selling prices are displayed to the customers. The customers were satisfied with the interfaces and the negation messages, which pop up during negotiation.

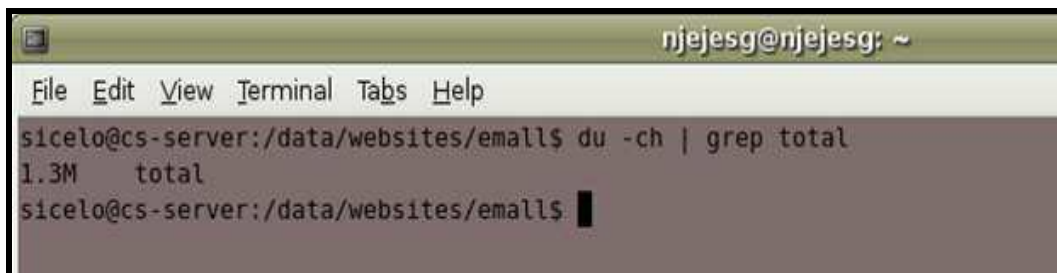
7.2.4.3 Analysis of the observation

There were some differences in the choice of the negotiation factors between the customers and the shop owners. Customers preferred factors which are favorable to them, for example, one of the customers was quick to point out that age is a major factor. From own judgment of the customer he should be around the late 50s. Nine of the customers out of 13 interviewed wanted the item price to be considered as the main factor. It can be concluded that for the shop owners bulk purchasing is the main factor, but for customers the item price is considered most.

7.3 Discussion on overall system performance

The characteristics of the system shown using the screenshots below are important in explaining the performance of the system. A comparison of the sizes of the original system and the DRP is given below on listing 20 to listing 23. The screenshots given below show the size of the system before it was developed. As already said, the system we have developed is an expansion of the existing *buy at Dwesa*.

The size of the current buy at Dwesa is displayed in the screen shot on listing 20:

A terminal window screenshot with a title bar 'njejesg@njejesg: ~'. The menu bar includes 'File', 'Edit', 'View', 'Terminal', 'Tabs', and 'Help'. The terminal text shows a user 'sicelo@cs-server' in the directory '/data/websites/emall\$' running the command 'du -ch | grep total'. The output is '1.3M total'. The prompt returns to 'sicelo@cs-server:/data/websites/emall\$' with a cursor.

```
njejesg@njejesg: ~
File Edit View Terminal Tabs Help
sicelo@cs-server:/data/websites/emall$ du -ch | grep total
1.3M total
sicelo@cs-server:/data/websites/emall$
```

Listing Old system size

The size of the system will depend on the number of shops and items available per shop. The size of the whole system is 3.3 Mega Bytes (MB) at the moment as one can see from the screenshot below. This size includes all the PHP files, the MySQL dump file and images used by the system.

After adding on new components, the size has increased as shown in listing 21:

```
nobert@nobert: /var/www/ema1
File Edit View Terminal Tabs Help
nobert@nobert:~$ cd /home
nobert@nobert:/home$ cd /var/www/ema1
nobert@nobert:/var/www/ema1$ du -ch | grep total
3.3M total
nobert@nobert:/var/www/ema1$
```

Listing New system size

As the system will be integrated with other systems being developed, the system may need more disk space or a dedicated server depending on the hardware being used, amount of traffic to the website and the number of shops and items needed to be added to the system. The database size for *buy at Dwesa* is shown on the screenshot displayed on listing 22:

```
njejesg@njejesg: ~
File Edit View Terminal Tabs Help
sicelo@cs-server:/data/websites/emall$ du emall.sql
20 emall.sql
sicelo@cs-server:/data/websites/emall$
```

Listing Old Database system size

The total size of all the PHP files used during the development of the system is 304 KB. The new size of the developed MySQL database dump file is currently 100 KB. This is noted from listing 23.

```
nobert@nobert: /var/www/ema1
File Edit View Terminal Tabs Help
nobert@nobert:~$ cd /home
nobert@nobert:/home$ cd /var/www/ema1
nobert@nobert:/var/www/ema1$ du emall.sql
100 emall.sql
nobert@nobert:/var/www/ema1$
```

Listing New database size

As one can easily imagine, the size of the database is mostly a function of the number of shops and products in the shopping mall. The shopping mall consists of 2 shops at the moment. The

major contribution of each shop to memory usage is the size of the images residing on the shop's directory. The system size and the other factors below affect the overall system performance.

7.4 Factors affecting system performance

Considering the different services and third parties that are involved during the whole purchasing process on the system, we have highlighted some of the factors which affect the performance of the system.

7.4.1 Payment method

Our shopping portal system does not support direct credit card payment. For the customer to pay using a credit card, he has to register with a third party (PayPal) before the payment can be made. This is required by the payment system used by the shopping portal. It should be noticed that in other countries PayPal offers e-Commerce sites direct credit card payment. Unfortunately, at the moment this service is not available. However, this can result in a hindrance as some of the users may want to pay without registering. In the near future the system should support plain credit card payment, using a solution from one of the financial institutions in South Africa.

7.4.2 Postal system for distribution

For the delivery services the system uses the South African Post Office (SAPO). "The Ngwane art and craft group" is functioning at Dwesa and the nearest Post Office (PO) from Dwesa is Willowvale PO. "The Ilingelihle group" is at Alice and will use Alice PO to deliver the ordered items. The shops that will be registered later will also use the Post Office as a delivery service. As said, the Post Office is the most common delivery service near to most rural areas in the Eastern Cape. The Post Office is also cost-effective for the time being as it uses a "Pay per Use method".

7.4.3 Messaging service

The system uses email as a message service. All the users are alerted by email. The email service has some limitations. The main limitation is that the user must have an email address in order to be contacted. In addition, the service can be unreliable as the mail server can fail for a number of reasons and there is no alternative way of contacting the customer. The system should not be solely dependent on one type of service. There is a need for an extra messaging service. For

example, the system should be linked with a mobile messaging service to use SMS or use electronic fax. The above services which the system uses have an effect on the overall performance of the system.

7.5 Conclusion

We accept that different tests on the system were done. However, maintenance is necessary to eliminate errors in the system during its working life and to tune the system to any variations in its working environment. It also means there is need for system reviews from time to time. This will assist the system to benefit the targeted customers. The next chapter of this thesis provides the reader with a final conclusion to the whole thesis.

CHAPTER 8: SUMMARY, DISCUSSION AND CONCLUSION

This chapter gives a summary of the thesis. It explains the main discussion we have explained in the entire thesis. All the achievements and the limitations of the system are briefly explained. It also covers proposed ideas suggested for future work on the system. The last section of the chapter gives an overall conclusion to the thesis.

8.1 Introduction

The thesis has discussed the development and implementation of a rewarding and negotiation system for a shopping portal and has shown how most of the requirements mentioned in Chapter 3 have been met. The chapter highlights the effectiveness of the system as a solution to the problem of marketing rural entrepreneurs' products for sustainability purposes in ICT4D projects.

8.2 Summary

The motivation for the development of the system produced in this work was based on the fact that rural communities in the Eastern Cape have individuals with skills to produce hand-work and crafts but not much possibility of marketing what they produce. The impoverished nature of the developing communities targeted by the thesis spurred the development of a cost-effective system. The aim of this thesis was to explain the design, implementation and deployment of the rewarding and negotiation system for small entrepreneurs in rural communities.

The project explained in this thesis aims to improve the services available from the existing *buy at Dwesa* online portal. This e-Commerce portal sells different items online. However, we aim to attract more customers and keep existing ones. Therefore, the customer loyalty application we have explained in this thesis is an e-marketing strategy to assist the rural community to sell more items. Improving sales for the rural entrepreneurs means more labour is required thus, creating

employment for the majority of people who are jobless. These factors combined improve the economic and social living standards of the community members.

8.3 Achievements

To build this system, a detailed literature survey and requirements elicitation was conducted. This gave us the required details necessary for the development of the rewarding and negotiation modules. This specification was then used as the basis for the design of the DRP shopping portal. Building up from *buy at Dwesa* and the new architectural design, a shopping portal system was implemented to test and demonstrate the usability of the system.

We have implemented a system that satisfies the objectives of the project as specified in Chapter 1 and the requirements specification. The implementation chapter highlighted that the system is flexible, usable and runs on an open source solution, which allows any modification as the source code and interfaces were explained. The system provides features such as:

- An interface for system users' registration: This interface allows for the users of the system to input the necessary customer details. This process is vital since, for negotiation, the system uses the user details extracted from the registration form.
- Allocation of points: We have developed a system that allows customers to get points for registration and for buying online. The points are accumulative for each customer and are used for negotiation.
- Negotiation module: The system allows customers to make offers and counter-offers are also made by the system. Instant messages are sent between the users and the system. These messages are aimed at speeding up the negotiation process by notifying the customers of the offers being made.
- Shop owner management interfaces. We have developed the system that allows shop owners to upload the items and edit all the available in any of the shops. Shop owners are able to set any factor and values to be considered for negotiation.

We have successfully developed a system that allows online negotiation on a shopping portal. The system allows customers to get points for purchasing on *buy at Dwesa*. Therefore, we have achieved the development of a system which meets the identified system functionalities.

8.4 Status of the deployed DRP shopping portal

The shopping mall as deployed at www.dwesa.com currently contains two shops. The first shop is *Ngwane Art and Craft Shop*. Ngwane is the art and craft group found in Dwesa. This group has members that produce beaded art and craft. The second shop is *Ilingelihle Art and Craft Shop*. Ilingelihle is the women's project on resident actually from University of Fort Hare, Alice. Contributors include a group of people who craft picnic baskets, cushions, beaded glasses and bed linen. Modern ideas and interpretations were applied to traditional craft techniques, such as strip-sewing, cross-stitch and prairie points.

No sales have as yet been made at www.dwesa.com. This is probably owing to the lack of advertising of the website. The work reported in this thesis concentrates on the development of the system not on the advertising means of the shopping mall website. Still, various ways for advertising the website have been explored with the rest of the team engaged in Dwesa and will be put to work in 2010.

8.5 Limitations and Future work

The system developed has taken into account different factors we felt were necessary at the time of development. However, for the system to continuously benefit the targeted community, we have proposed the following ideas for future consideration:

8.5.1 Limitations

- The system does not allow customers to use any new negotiation factor that is not in the database.
- The system has fixed negotiation rules.
- The system only allows a fixed number of negotiation attempts in this case.
- Customers can only negotiate to pay less.
- The customer points are only used as a negotiation factor during negotiation and points are not transferable to other customers.

8.5.2 Future work

To overcome the above limitations, we proposed the following solutions as part of future work.

- The project makes use of AI applications with the intelligent rewarding modules. Therefore, for the system to benefit the users there is need for continuous updates on the modules. For example, some modifications should be made to the negotiation factors.
- Currently, only the factors set in the database are used for negotiation. We suggest that any new factor could be created by the shop owners and used for negotiation.
- There is also the need to have a different number of chances on the offers made by customers. The number of offers allowed per customer should be determined by their customer details and order history. At the moment, there are a fixed number of negotiation attempts for all the customers.
- In some cases, the system should avoid giving instant feedback. For instance if the customer details are not clear and if there are some complications, we suggest the system refer to the shop owner. This comes in as a system consulting the shop owner for assistance on the decision. A customer maybe asked to come back after some time.
- The customers should be able to use points to pay for orders and also to transfer points to other customers.
- We also propose that the system could allow customers to negotiate for some items in the shops. At the moment, customers negotiate for prices to pay less. The system should allow customers to negotiate to get some items. This will improve the intelligence of the system, as it will have to select the items to give other than only using the formulas. Thus, in the end, customers will be negotiating to get some items not only to pay less.

8.6 Overall conclusion

This thesis has described the development of a rewarding and negotiation application and the subsequent implementation of the system for the Dwesa community. Importantly, this thesis outlines a customer loyalty application allowing customers to make offers and get rewards from buying on the shopping portal. The system realizes an e-marketing strategy for rural entrepreneurs to effectively market their products.

There are three modules developed, which are dependent on each other. These are the allocation of points, negotiation and rewarding modules. The modules incorporate basic AI and expert reasoning features. The DRP we have discussed consists of dynamic modules that need continuous updates to allow fairness in rewarding customers. We have successfully managed to come up with negotiation rules and formulas used during the negotiation process. With the objective of this research being to improve the marketing of products for the rural entrepreneurs, and the fact that extensive deployment and testing of the system was beyond the scope of the research, we believe that the system stands to provide tangible, economic benefits for marginalized rural communities.

The development of the DRP shopping system makes use of the Open Source LAMP model. The use of Open Source software puts full control and ownership of the developed system into the hands of the users and also allows future development, adaptation, customization and localization of the shopping portal. Extension of functionality and services offered by the rewarding modules are possible, as its source code is available.

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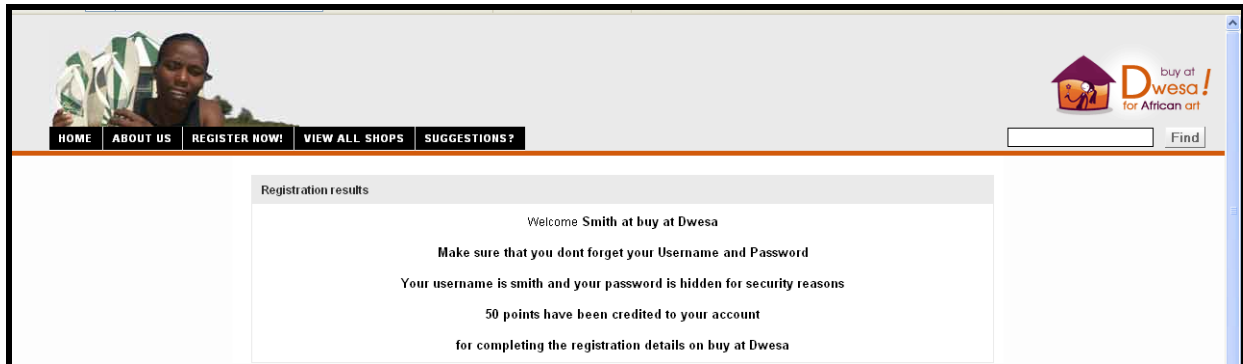
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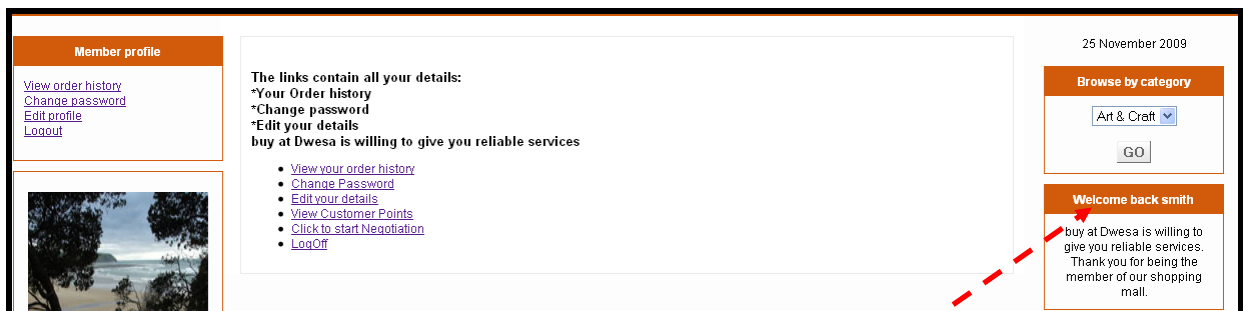
APPENDIX A: USER MANUAL

This is part of the registration form completed by new users to the system. All the details have to be completed. We have assumed that customers give correct details when completing this form. Fields like age, income and address are critical and are used for negotiation. Below is the other part of the registration details required from the customers.

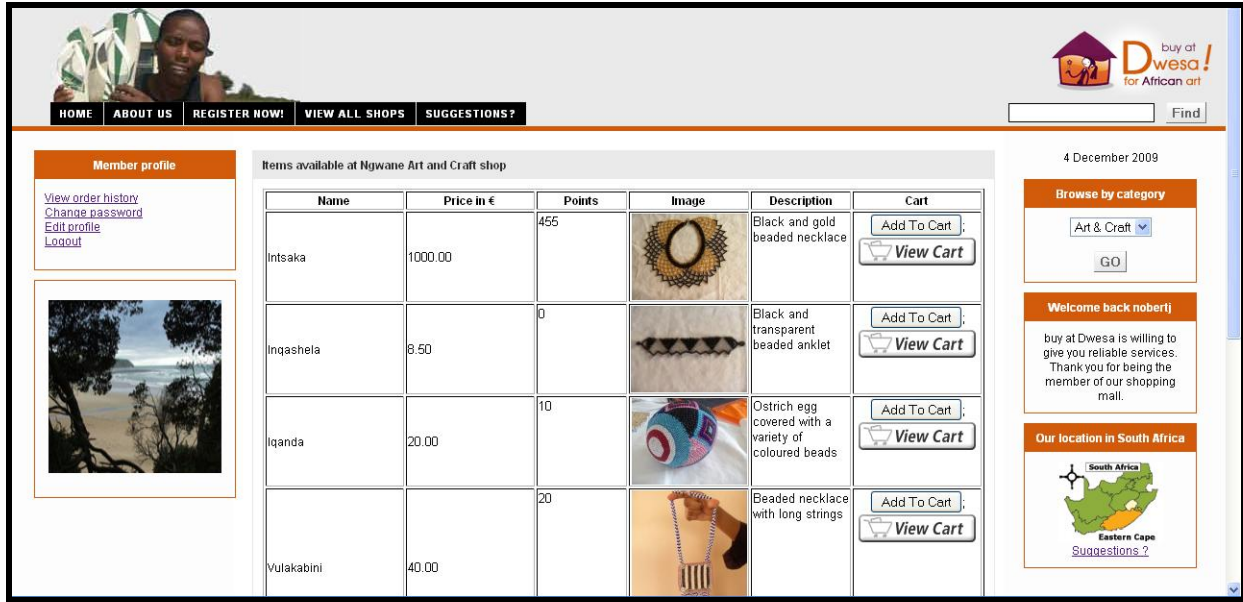
Customers are required to provide usernames and passwords. This allows the customer to log in the next time of visiting the system. There is a session called *user*, kept to track all the activities carried out by the customers. After successful registration, the following interface is displayed.



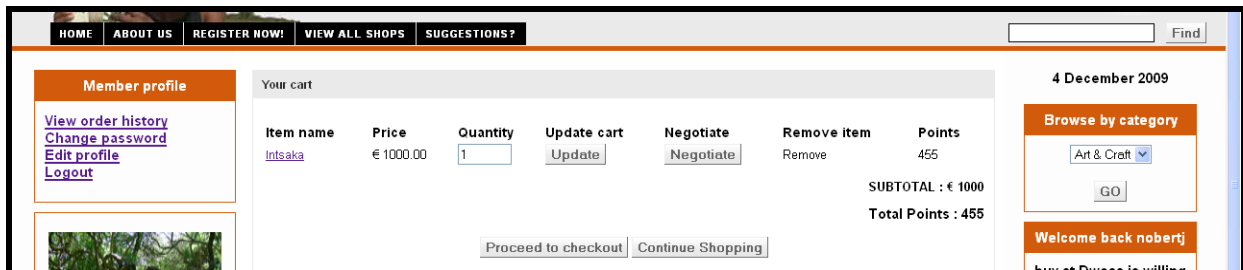
The above message is displayed after successful registration. The number of points obtained for registration are transferred to the customer's account on clicking submit button on the registration form. These points are used when the customer negotiate for rewards.



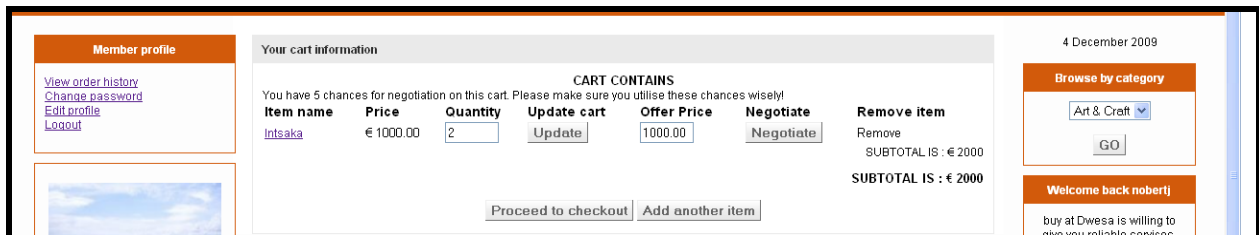
For security reasons, the customer has to check if he/she is the one logged on. The arrow is pointing on to the logged on customer. Once the customer is logged on, a lot of activities can be carried out on the system. The following interface is displayed to the customer. This allows customers to select any items they want.



After adding items to cart, customers have an option to negotiate. The interface is shown as below:




On clicking the negotiate button, the customer has to make an offer. The interface below shows the customer making offers.



The interface below is the interface displayed to the customers after making an offer

Member profile

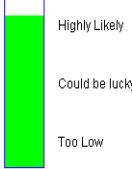
[View order history](#)
[Change password](#)
[Edit profile](#)
[Logout](#)



Your cart information

CART CONTAINS

You have 5 chances for negotiation on this cart. Please make sure you utilise these chances wisely!
 Item No: 118 Negotiation Level



You have 4 chances left for negotiation.
 Click Accept if you agree to our counter-offer price. Or Reject to make another offer

Negotiation Reference Number: 118F78.9473684211NP900/00

Actual Price: €1000.00
 Negotiated Price: €900

4 December 2009


Browse by category

Art & Craft

Welcome back nobertj

buy at Dwesa is willing to give you reliable services. Thank you for being the member of our shopping mall.

Our location in South Africa



[Suggestions ?](#)

The messages on the interface above are displayed to the customer during the negotiation process. The user manual we have given is a guide to how the system works. The other interfaces have already been highlighted in the previous chapters. We have given these interfaces to demonstrate the customers as they browse the DRP modules.

APPENDIX B: SAMPLE QUESTIONNAIRE

Rewarding Program Questionnaire

In the table below please tick the option that relates to how you feel about each of the statements below. The options are: SA- Strongly Agree, A- Agree, N- Neutral, D- Disagree, and SD- Strongly Disagree

Statements	SA	A	N	D	SD
8. I am aware of e-Commerce					
9. I have used an e-Commerce Website before					
10. I am aware of the benefits of e-Commerce					
Attitudes.					
11. I like the idea of bringing e- commerce to our community					
12. It is wise to use e-Commerce in our local business					
13. My attitude towards using e- commerce is positive					
15. I intend to use e-Commerce to market our local products/produce if given the chance in our community					

17. How do you sell your products or services?

.....

.....

18. Do you have any products and services that can be offered and sold online?

[1] Yes [2] No

19. Have you ever used Internet to buy products?

[1] Yes [2] No

If yes how often?

(Tick the appropriate)

Very often	sometimes	Hardly	Never

20. Would you give someone a reward for buying from you?

[1] Yes [2] No

21. Do you know that you can negotiate for prices when buying?

[1] Yes [2] No

22. How often do you negotiate when buying; (Tick the appropriate)

Very often	sometimes	Hardly	Never

23. What do you think is/are the most important factor when negotiation (List any)

Factor	List then in their order
order history	
Age	
location	
Size of order	
Time	
Other Specify	

23. What values would you give for each of the factors (Factor Rating) Give any value between 0-50 for each level?

Factor	High level	Medium level	Low level
order history			
Age			
location			
Size of order			
Time			
Other Specify			

24. When negotiating online how many chances do you want to make offers? (Tick one)

- A. 1
- B. 5
- C. As many as I want

25. Do you prefer to get the messages as the ones displayed when negotiating from the system?

[1] Yes [2] No

END - THANK YOU

APPENDIX C: REWARDING PROGRAM QUESTIONNAIRE

In the table below please tick the option that relates to how you feel about each of the statements below. The options are: SA- Strongly Agree, A- Agree, N- Neutral, D- Disagree, and SD- Strongly Disagree

Statements	SA	A	N	D	SD
8. I am aware of e-Commerce					
9. I have used an e-Commerce Website before					
10. I am aware of the benefits of e-Commerce					
Attitudes.					
11. I like the idea of bringing e- commerce to our community					
12. It is wise to use e-commerce in our local business					
13. My attitude towards using e- commerce is positive					
Intention					
14. I think I would like to use e- commerce to boost our local business					
15. I intend to use e-commerce to market our local products/produce if given the chance in our community					
16. I would like to see an e- commerce Website that is specific to our community					

17. How do you sell your products or services?

.....

.....

.....

.....

18. Do you have any products and services that can be offered and sold online?

[1] Yes [2] No

19. Have you ever used Internet to buy products?

[1] Yes [2] No

If yes how often?

(Tick the appropriate)

Very often	sometimes	hardly	Never

20. Would you give someone a reward for buying from you?

[1] Yes [2] No

21. Do you know that you can negotiate for prices when buying?

[1] Yes [2] No

22. How often do you negotiate when buying; (Tick the appropriate)

Very often	sometimes	hardly	Never

23. What do you think is/are the most important factor when negotiation (List any)

Factor	List then in their order
order history	
age	
location	
Size of order	
time	
Other Specify	

24. When negotiating online how many chances do you want to make offers? (Tick one)

- A. 3
- B. 4
- C. 5
- D. As many as I want
- E. other

25. Do you prefer to get the messages as the ones displayed when negotiating from the system?

[1] Yes [2] No

26. Was it easy to upload the products?

[1] Yes [2] No

END - THANK YOU

APPENDIX D: SYSTEM INSTALLATION

System installation and setup

This section explains how to install and setup the rural community shopping portal application with the required software components. The following table lists the requirements of the DRP application.

Requirement	Information	Deployed Version
Operating system	Latest version of Ubuntu Linux OS	Preferred Ubuntu 8.10
Web Server	Apache Web Server	Server 2.2.1
Database	MySQL Database	5.0.51
Scripting language	PHP5	5.2.9

The first part explains the basic installation of the required software components. The parameters outlined in this section can be adjusted according to extra needs. The second part will explain the setup in detail.

Installation

The shopping portal system is running on a Linux Operating System (OS). Ubuntu is our choice. The installation instruction given by the following section is based on Ubuntu installation. The following section explains how to install the LAMP modules.

Installing Ubuntu version 8.10 operating system

Ubuntu Linux OS is free and available on the website (<http://www.ubuntu.com>) for free download. There are other Ubuntu versions that allow the installation of the LAMP modules

during the installation of the operating system. For example, when installing from the Ubuntu 8.10 (Dapper Drake) "Server CD", there is an option allowing running a XAMPP setup at the initial Ubuntu installation screen. This will install Apache2, PHP5 and MySQL 5.0.

Installing LAMP (Linux, Apache, MySQL and PHP) stack

There are various ways that are used to install the LAMP stack. The LAMP stack can be installed by module or as a whole stack. We choose to install the LAMP stack as a whole.

Steps to follow:

The LAMP stack is installed using the **Synaptic Package Manager (SPM)**. The **SPM** provides the same features as the **apt-get** command that is used to install packages. To open **SPM** go to **System ->Administration -> Synaptic Package Manager**. Enter the administrator password which is the system root password. The **SPM** window will be displayed. This window will allow the installation of Apache Web Server, MySQL server and PHP.

To install the LAMP stack using the **SPM** window, go to **Edit -> Mark Package by Task**. This will list all the packages that can be installed. Then to install, choose "LAMP server" from the list of options. Click **OK** and then click the "**Apply**" button on the toolbar. This will install the default list of packages (Apache Web Server, MySQL and PHP) that are part of LAMP installation.

There are additional PHP modules that we need to install.

1) php mail

php mail provides supporting functions useful to send email to the users. This module is installed using the **SPM** window. On the window, go to **Search** then a search window will appear, then type "php mail", all the php modules will be displayed. Choose the **php-mail** option and mark for installation, then click **Apply**. This will install the php mail module.

2) php-net-smtp

This PHP module allows the SMTP mail server to send email. The module is installed the same way as **php mail**, the key words used are php-mail-smtp.

3) php-gd

This PHP module enables the management of images uploaded in the system. It is installed via **SPM**, in the same way as **php mail** and **php-net-smtp**. The key words used to search for this module are php-gd. The php5-gd was used.

4) phpMyAdmin

This PHP module allows the management of MySQL database. It is installed via **SPM**, in the same way as the above modules. After phpMyAdmin is installed, it will need the system root password.

The following section will explain the setup of the DRP shopping portal system.

Creation of the website directory

To access the index page from the server where the system is deployed, the user should use the URL `http://localhost/emall/`. When not on the server and using Internet, typing `http://www.dwesa.com` will open the index page in **emal** directory residing on the server. On the server the shopping mall PHP files are found on the `/data/websites/emal/` directory.

Creation of MySQL database

The system requires a MySQL database. The file for configuring the MySQL DB is `config.php`, found in the **dwesa** folder. You can choose another name for the database, in which case you need to change the `“config.php”` file. We named the created database `“dwesa”`.