جامعة آل البيت

Al al-Bayt University

An Intelligent E-mall System using Fuzzy Algorithm and Data Mining over Android Mobile Application

نظام تجارة إلكتروني ذكي بإستخدام نهج المنطق المضبب والتنقيب عن البيانات من خلال تطبيقات أجهزة الأندرويد

by

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This Thesis was Submitted in Partial Fulfillment of the Requirements for the Master's Degree in Computer Science

Deanship of Graduate Studies

Al al-Bayt University

التفويض

جامعة آل البيت

عمادة الدراسات العليا

نموذج رقم (1)

انا ثروت خالد علي الشرع

نموذج تفويض 1

افوض جامعة آل البيت بتزويد نُسخ من رسالتي ، للمكتبات أو المؤسسات أو الهيئات أو الأشخاص عند طلبهم حسب التعليمات النافذة في الجامعة.

التوقيع: ..... التاريخ:

نموذج رقم (2)

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عمادة الدراسات العليا

.نموذج اقرار والتزام بقوانين جامعة آل البيت وانظمتها وتعليماتها لطلبة الماجستير والدكتوراه

الرقم الجامعي: 1220901003 انا ثروت خالد علي الشرع

كلية: الامير حسين بن عبدالله لتكنولوجيا المعلومات تخصص: علم الحاسوب

أُعلنُ بأني قد التزمت بقوانين جامعة آل البيت وانظمتها وتعليماتها وقراراتها السارية المفعول المتعلقة بإعداد رسائل الماجستير والدكتوراه عندما قمت شخصياً بإعداد رسالتي / اطروحتي بعنوان:

An Intelligent E-mall System using Fuzzy Algorithm and Data Mining over Android

Mobile Application

نظام تجارة إلكتروني ذكي بإستخدام نهج المنطق المضبب والتنقيب عن البيانات من خلال تطبيقات أجهزة الأندرويد

وذلك بما ينسجم مع الأمانة العلمية المتعارف عليها في كتابة الرسائل والأطاريح العلمية. كما أنني أُعلن بأن رسالتي/ اطروحتي هذه غير منقولة أو مستلة من رسائل أو أطاريح أو كتب أو أبحاث أو أي منشورات علمية تم نشرها أو تخزينها في أي وسيلة اعلامية، وتأسيساً على ما تقدم فأنني اتحمل المسؤولية بأنواعها كافة فيما لو تبين غير ذلك بما فيه حق مجلس العمداء في جامعة آل البيت بإلغاء قرار منحي الدرجة العلمية التي حصلت عليها وسحب شهادة التخرّج مني بعد صدورها دون أن يكون لي الحق في التظلم أو الأعتراض أو الطعن بأي صورة كانت في القرار الصادر عن مجلس العمداء بهذا الصدد.

التاريخ: التوقيع .....

Committee Decision

This Thesis (An Intelligent E-mall System using Fuzzy Algorithm and Data Mining over Android Mobile Application) was Successfully Defended and Approved on 4th Jan. 2018.	
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Dedication

This thesis is dedicated to the sake of Allah, my Creator and my Master, My great teacher and messenger, Mohammed (May Allah bless and grant him), who taught us the purpose of life.

I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving parents, who never stop giving of themselves in countless ways.

To all my family, the symbol of love and giving, my friends who encourage and support me, and all the people in my life who touch my heart, I dedicate this research.

Acknowledgments

In the Name of God, the Most Merciful, the Most Compassionate all praise be to Allah, the Lord of the worlds; and prayers and peace be upon Mohamed his servant and messenger. First and foremost, I must acknowledge my limitless thanks to Allah, the Ever-Magnificent; the Ever-Thankful, for His helps and bless. I am totally sure that this work would have never become truth, without His guidance.

I like also to thank the department of computer science at Al al-Bayt University for the valuable support and encouragement during my study for the master degree.

I am grateful to some people, who worked hard with me from the beginning till the completion of the present research particularly my great supervisor Dr. Khaled Batiha for his valuable guidance, encouragement and help for completing this thesis.

I would like to take this opportunity to say warm thanks to all my beloved friends, who have been so supportive along the way of doing my thesis. I also would like to express my wholehearted thanks to my family for their generous support they provided me throughout my entire life and particularly through the process of pursuing the master degree. Because of their unconditional love and prayers, I have the chance to complete this thesis. Furthermore, I dedicate this work and give special thanks to leader in my work Mr. Ismail Yasein for his support and encouragement.

Last but not least, deepest thanks go to all people who took part in making this thesis real.

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List of Abbreviations

IIS	Internet Information Services
XML	Extensible Markup Language
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
ADB	Android Debug Bridge
IDE	Integrated Development Environment
SSL	Secure Socket Layer
UP	Unified Process
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
SDK	Software Development Kit
API	Application Program Interface
APK	Android Application Package file
UML	Unified Modeling Language
JSON	JavaScript Object Notation

CBR	Case-Based Reasoning
AJAX	Asynchronous JavaScript and XML
DOM	Degree of Membership
FMF	Fuzzy Membership Function
ERD	Entity Relationship Diagram
BN	Bayesian Network
BI	Business Intelligence
OLAP	On-Line Analytical Processing
SQL	Structured Query Language
BIDS	Business Intelligence Development Studio
DMX	Data Mining Extensions
DML	Data Manipulation Language
ACO	Ant Colony Optimization
URL	Uniform Resource Locator
SSAS	SQL Server Analysis Service
RDBMS	Relational Database Management System
ADT	Android Development Technology

ASP	Active Server Pages
C2C	Customer to Customer
B2C	Business to Customer
B2B	Business to Business

An Intelligent E-mall System using Fuzzy Algorithm and Data Mining over Android Mobile Application

A Master Thesis By

Tharwat khaled Ali Al_share'

Supervisor:

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Department of Computer Science, Al al-Bayt University, 2018

Abstract

The main purpose of this thesis is to design and build an “An Intelligent E-mall System using Fuzzy Algorithm and Data Mining over Android Mobile Application”. This system incorporates many intelligent technologies in order to adapt customers’ behaviors in order to increase company profit and add a sense value to the business organization. These technologies include a fuzzy framework based system that aim to determine customer profiles, depends on the android application, which track its users by generating behavioral variables and send it to the server. These variables will be processed and will serve as inputs for the corresponding fired fuzzy rules. Data mining algorithms used to discover associations

and profiles' clusters as an example of Business Intelligence technology to add meaning of customized user interface for system customers and their needs. The system is built using the following technologies: JAVA/Eclipse ADT, SQL/SQL server database, C#/ASP.NET, DMX/SQL Server Analysis Services. Also, the server uses API generic handler which operating as middleware for handling all requests from all Android clients to the server by using the SSL protocol to make our services more standard, secure, and reliable.

نظام تجارة إلكتروني ذكي بإستخدام نهج المنطق المضبب و التنقيب عن البيانات من خلال تطبيقات أجهزة الأندرويد

رسالة ماجستير قدمت من قبل:

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الدكتور خالد بطيحه

قسم علم الحاسوب، جامعة آل البيت، 2018م

الملخص

هدف هذه الأطروحة هو تصميم وبناء نظام تسوق ذكي باستخدام نهج خوارزمية المنطق المضبب والتنقيب عن البيانات بإستخدام تطبيقات أجهزة الأندرويد. هذا النظام يتضمن العديد من التقنيات الذكية للتكيف مع سلوكيات العملاء من أجل زيادة أرباح الشركة و زيادة مبيعاتها. وتشمل هذه التقنيات نظام يستند إلى إطار يهدف إلى تحديد ملامح العملاء المستخدمين لتطبيق الهاتف النقال ، والذي يقوم بتتبع مستخدميها من خلال توليد المتغيرات السلوكية وإرسالها إلى الخادم. وثم تتم معالجة هذه المتغيرات لتكون بمثابة مدخلات للقواعد الغامضة ذات الصلة. خوارزميات التنقيب عن البيانات المستخدمة لاكتشاف الملفات المجمعة والمرتبطة بمجموعات. من الأمثلة على تكنولوجيا ذكاء الأعمال إضافة واجهة المستخدم المخصصة لعملاء النظام واحتياجاتهم.

تم بناء النظام باستخدام التقنيات التالية: ADT, JAVA/Eclipse، قاعدة بيانات خادم SQL / SQL، / C # ASP.NET، SQL/ DMX، خدمات تحليل الخادم. يستخدم الخادم معالج API الذي يعمل كبرنامج وسيط للتعامل مع جميع الطلبات من جميع عملاء الهاتف النقال (أندرويد) إلى الخادم باستخدام بروتوكول SSL لجعل خدماتنا أكثر معيارا وآمنة وموثوق بها.

Chapter 1
Introduction

Introduction

Nowadays, mobile devices and the applications they provide are considered very important in our daily life. These applications provide services to end user, and enable generations to have such services easier on their own mobile devices in time and place. There are many of the affective applications used in our daily life in the mobile devices such as those related to paying bills, education fees, shopping, etc. These applications save time and effort more compared with the traditional way in paying.

Mobile commerce led to the emergence of new possibilities for mobiles and services. M-Commerce can be defined as the transactions made by wireless devices and internet; where value is gained in return for data, services, or goods. Transactions of M-Commerce can be recognized as types of the transactions that have an economic value, the individual makes the transaction through his mobile that is connected wirelessly to the internet in order to connect with the e-commerce infrastructure. Mobile user's number is growing fast. The number of mobile users is expected to exceed the number of fixed lines users globally in the near future.

Three main factors serve as boosters of information value for users: personalization, sense of time, and location recognition, these elements combined maximize the value provided to users. Mobile users can download M-Commerce services and applications from different wireless and mobile networks. In designing M-Commerce services and applications many concerns should be considered, although systems

and solutions of accessing wireless networks are found. The same can be said about the mobile devices that have drawbacks compared with computer desktops. Mobile user's identification is the most important factor in designing M-Commerce services and classifying the services features.

These days E-Business developed to be one of the most important concepts, it is correlated with our lifestyle, it has developed to an "Electronic style" after the invention of the internet, adding new meanings, generations of communication methods and has developed a new value of communication by using internet resources in every single detail of our life, of these important details is trading and commerce systems. E-commerce developed as a simple process of offering products, services, purchasing and selling via internet. Sales in e-business involves data exchange to help in delivery of payments in business transactions because it is considered an effective and efficient communication method in different organizations.

Actually the most recent approach of ecommerce has been extremely modified to changing the way people shop. Behind these changes there is a new generation of systems that understand what exactly people want and more important when and how they want it.

E-mall system uses an intelligent fuzzy algorithm based system to generate, build and update users' profiles. E-mall fuzzy rule based system depends on multiple inputs received by mobile tracking or retrieved from available data in database to generate a profile for each user. Fuzzy logic allows for approximation of human reasoning abilities that are applied to systems based on knowledge. Fuzzy logic is very strong in mathematical terms, it finds indefiniteness correlated with the thinking and reasoning.

Data Mining is the process of analyzing data and applying algorithms that produce patterns of numbers or models based on approved computational efficiency. Another definition says it is inference of understood models and patterns from databases. That is to say, to have a large or infinite collection of possible models or patterns and a finite data. The required result of Data Mining is the one that best describes the data and the fitting models.

This thesis is going to investigate and implement that part of our lives, build a system the can handle the huge amount of data, be available wherever anyone may need it and suits consumer's expectations and hops. Adding mobility to our solution is also wide spread in the markets.

Problem Statements

This thesis stemmed to tackle the limitations that face traditional systems and these are:

The traditional systems have a normal search engine, when a user writs a wrong word the result will be wrong. Intelligent systems should have smart searches to get the related item.

The existing systems does not have a profiling to track the user's behavior and directly fills the database without fuzzy rule systems.

The existing systems does not recommend or suggest certain items to users.

The traditional system needs more than five steps to buy a product.

The existing systems does not link individuals with products, so the seller lacks information of products matching or what is the chance of buying a particular product along with another. The intelligent system should have a data mining association rules to maintain it.

Objectives of the Thesis

The overall objective of the system is to build an intelligent Emall system. The following procedure is taken to build a new email system:

To propose a fuzzy framework using an intelligent fuzzy rule based system, to generate, build and update users' profiles, by track the user's behavior and directly fills the database.

To build E-mall fuzzy rule based system rules, this proceeds on the fuzzification, inference, composition, defuzzification, serialization and deserialization, to generate the user's profile.

To build fuzzy rule based on the relations between fuzzy sets and fuzzy dimensions.

To applying the data mining algorithms on user's profiles to forecast recommendations or products ordered in pair, this allows using users preferences and the system data for direct marketing and sales improvement process.

To design an intelligent rules have recommend or suggest certain items to users, as well as to the system itself.

To applying smart searches to get the most related item in intelligent systems.

To design an intelligent system can buy a product within three steps.

Thesis Features

The Intelligent E-mall is using a high advance intelligent technology for profiling its users by tracking their behavior while using the system android mobile application (likes, comments, rates, colors, orders, searches, and pages visited).

The tracked behavior is processed by a fuzzy rule based system, it applies its rules that leads a user to fill his profile in the database (favorite colors, education level, academic specialization, favorite shopping categories, children number, annual income, civil status etc.). However the system saves all of its fuzzy variables, sets, rules with an appropriate way in the database, and retrieves them when needed.

Different data mining algorithms are applied on user's profiles to forecast recommendations or products ordered in pair, this allows using users preferences and the system data for direct marketing and sales improvement process (clustering and association rules). Artificial intelligence machine learning algorithm is applied (theoretically) to improve the profiling process by improving the rules of the fuzzy rule based system which are saved in the system database.

Motivations of the Thesis

The main motivations in this thesis are to use the fuzzy to build a new fuzzy rule which is called (Fuzzy Framework) to create a new customer profiling in the database and use the data mining on those profiling to forecast the recommendations order to the customers and to the markets.

To build such this system to be success need to have a lot of efforts and knowledge in computer science, such as studying more deep in fuzzy, data mining, clustering and many more algorithms and different types of programing languages. I hired my knowledge in computer science of specialization to build an effective and success system.

The proposed work designs an E-mall system to provide the services to the end user and to facilitate the buying and selling process in ways that provide salesmen and buyers with an advanced maximum benefit. The benefit for the buyer is to facilitate and accelerate the process of searching, ordering and buying all his needs of products in one place according to his concerns and interests. Furthermore, products recommendations and suggestions will be provided to give everything the user likes by his/her interests and his/her behavior. Salesmen will achieve the maximum possible value of revenue. The system will provide easy interfaces to manage products, and to view reports on sales and recommendation to improve the revenue, it offers salesmen a chance of promote products to the appropriate users. Previously the product search cost was very high because the customer had to search among multiple sites, through multiple search engines, and collect information. The Intelligent E-mall combines multiple stores from multiple categories in one place and provides easy mobile user interfaces showing stores and products, and an advance search to facilitate the search process for the customers by saving time and effort.

Methodology

The methodology used is the Unified Process (UP) consists of five independent phases: Unified processes are repetitive and they develop gradually, they have different phases including inception, elaboration, construction and transition and these are divided into time boxed iterations series. For large projects the inception phase is divided into iterations. Iteration increases the system added or improved functionality when it is compared with results without iteration (Roger S, 2016).

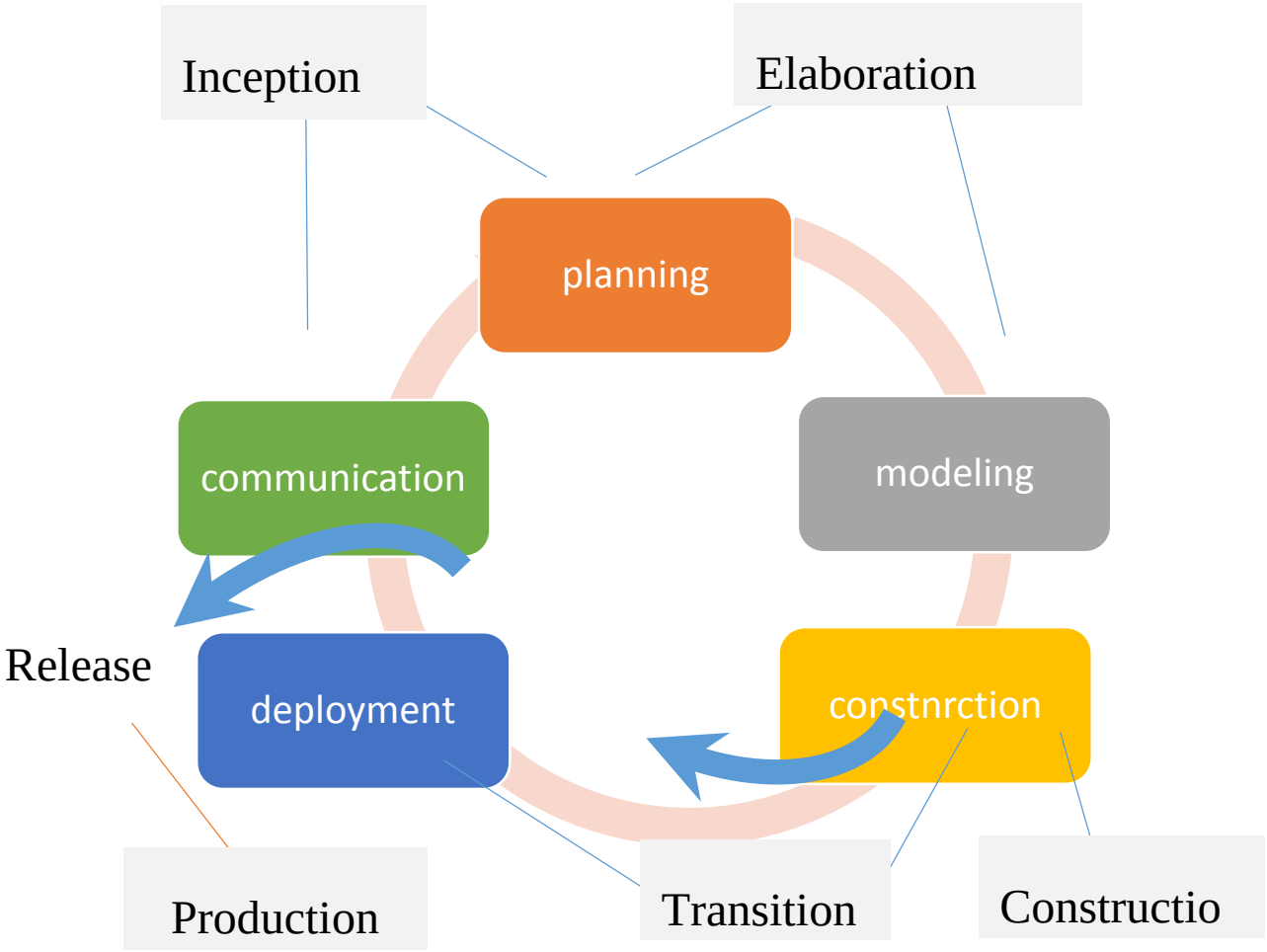


Figure 1-1: The Unified Process (UP) Phase's Cycle (Roger S, 2016)

Contribution

The originality of the current research manifests in designing an intelligent E-mall system to provide services to the user, using a high advance intelligent technology for profiling users by tracking their behavior, while using the system android mobile application.

Thesis Outline

Chapter 2: discussed background and related literature to the current study.

Chapter 3: explained the deep details about the system analysis and design with the implementations of the proposed work.

Chapter 4: discussed the system analysis and results for the proposed work.

Chapter 5: provided recommendations and future enhancement.

Chapter 2

Theoretical Background and Literature Review

Introduction

The traditional means of communication, fixed telephone, is fading away for the account of mobiles, because mobiles are more cost-efficient, flexible and more convenient to individuals (Sanjay, 2007). Mobiles are used in many activities including buying and selling of different services and products. Sharma (2014) said that M-commerce includes transactions performed using a mobile and it is considered a subgroup of E-commerce, the only different between the two is that E-commerce uses a wireless network in its services, purchases and financial processes. All types of transaction between business and customers such as B2C, B2B and C2C are found in M-commerce. Widespread status of mobiles forced organizations to develop platforms to communicate with the customers; consequently, M-commerce became very popular because of its properties and uniqueness. Customers have the choice of moving between different banks or financial organizations in their search for better services. One cannot overlook the great role which mobiles played in communication technology because ease of usage which adds to its popularity also and it dominated the field compared with fixed telephones.

The trend today is M-commerce, business organizations assessed M-commerce potential revenues and business models are developed to exploit the massive possible gains of the markets of today. These benefits motivated the author to undertake the current research.

The purpose of the research is to:

Briefly describe mobile wireless technologies.

Assist business organizations to recognize M-commerce benefits.

Review basics of M-commerce and E-commerce.

Recognize the correlation between M-commerce and E-commerce.

Exploit the different categories of M-commerce.

2.1 Mobile Wireless Technologies

M-commerce is important for the business environment according to Rotternberg and his research team (Mudit B and Anand B, 2010). Mobile devices are used in performing transactions or to facilitate their occurrence. It includes using SMS via Bluetooth; integration of low-level digital carriers to IP based services through WAP6 or Compact HTML7. Lyytinen (2001) said that E-business developing markets are integrations; they include constructing new business models, applications, services and technological solutions. Other scholars categorized mobile technologies into mobility and computing (Malladi et al. 2002), computing according to them is the unbounded, unlimited and constant access to networks by users.

Dubendorf (2003) defined wireless as the transfer of different types of data such as texts, voice and video clips and images by radio, microwave or infrared waves instead of using wires. Accordingly, mobile wireless technologies may be defined as technologies using radio frequencies to transfer texts, voice and video clips or services of multimedia to mobiles free from time and location determinants. The absent of limitations and determinants is considered the main properties of mobile wireless technologies termed mobility and reachability according to different scholars according to many scholars like BenMoussa (2005); Camponovo and Pigneur (2003); and in the book research team (Kuinam J and Nikolai J, 2017).

2.2 M-Commerce Further than E-Commerce

The attention toward E-commerce resulted in its applications, requirements and strategies development. Revenues expectations for business and customers are extraordinary for M-commerce. Users are supposed to have internet connections using phone lines or a Local Area Network (LAN). Wireless applications such as e-commerce or m-commerce are presumed to appear and they are supposed to be beneficial for customers and business alike.

M-commerce is considered a descendent of E-commerce as Mahi (2008) and Au (2007) stated. Devices such as Mobiles, Personal Digital Assistants (PDAs) and handheld computers consider M-commerce as a powerful motive for the next generation e-commerce (Ting, 2014). Scornavacca and his team (2006) said that M-commerce is a form of E-commerce that has benefits. M-commerce is a way to communicate with customers, the features of availability, closeness, sensitivity to time and location are considered main concepts of differentiating M-commerce from traditional E-commerce means as Paavilainen (2002) mentioned, in addition to connecting information in a more direct way (Mobile Commerce, 2008). C2B E-commerce is expected from smart phones using M-commerce technology. Ngai and Gunasekaran (2007), Smith (2006), O'Connell (2005), Matthew

and his research team (2004) and Urbaczewskj and his colleagues (2003) propose that the next step in electronic business growth will be oriented toward M-commerce. Because of its importance staffed and his colleagues (2003) said that M-commerce is requested by business organizations. Some individuals perceive M-commerce as an expansion of E-commerce to mobile phones. Others recognize it as a new station beyond Internet. The term refers in general to financial transactions conducted through mobiles networks to purchase goods and services in addition to messages. Business processes are believed to be dramatically changing the industry of telecommunications, information technology, media and financial services, this change is attributed to M-commerce which will enable large population of web information services access when and wherever (Yeo et al., 2003). Mobile Internet is growing fast and dominating because lessons have been learnt from E-commerce. Significant advances happened to cellular carriers, they gave users the ability to use data, wireless web services and M-commerce. A set of applications and services refer to M-commerce as Sadeh (2002) mentioned.

2.3 Mobile Commerce Applications

Mobiles are spread more than computers; this fact gives M-commerce an opportunity to connect customers with business of all types. Mobiles bridge the digital gap, allow companies to communicate with customers in an easy way (Mobile Commerce, 2008). Everyday M-commerce is gaining more and more acceptance. Mobile services developed vigorously in the last couple of years and M-commerce is growing steadily. Table 2.1, illustrates the major M-commerce applications as Gordon and Gebauer (2001), Sadeh (2002), Hu (2005) stated ,(Li G., Lv T. 2008) and (Akamai. 2016 Report).

Table 2-1: Major applications of M-commerce

Mobile Category	Major Applications	Clients
Travel and ticketing	Travel management	Travel industry and ticket sales
Commerce	Mobile transactions and payments	Business
Education	Mobile classrooms and labs	Schools and training centers
Enterprise resource planning	Resource management	All
Entertainment	Games/images/music/video downloads and online gaming	Entertainment industry
Health care	Accessing and updating patient records	Hospitals and nursing homes
Inventory tracking and dispatching	Product tracking and dispatching	Delivery services and transportation
Traffic	Global positioning, directions, and traffic advisories	Transportation and auto industries

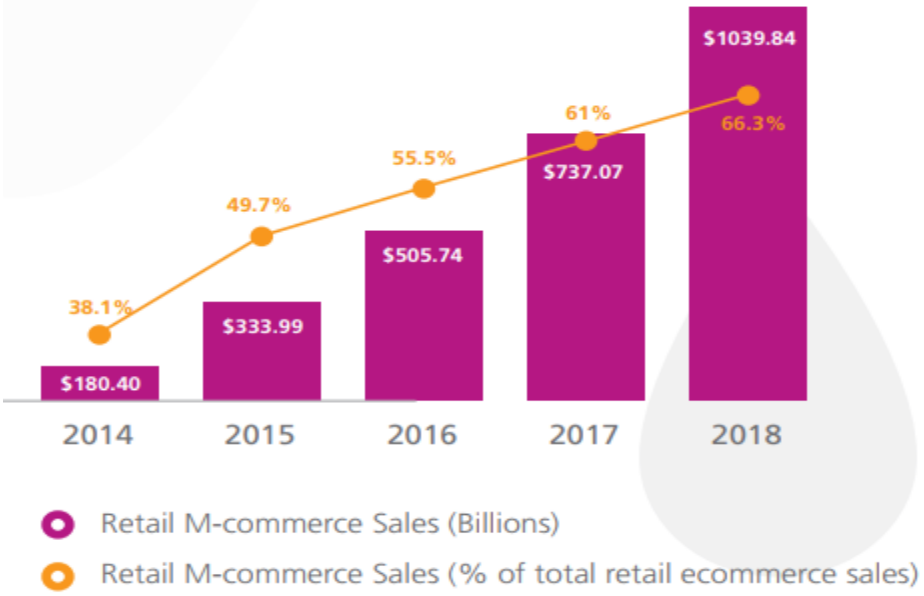


Figure 2-1: Mobile's Growing Influence on Commerce (Akamai. 2016 Report)

Following is a brief description of several applications of M-commerce:

2.3.1 Issuance of travelling tickets

Booking and receiving E-tickets using the B CODE or NFCI technology is easy. These technologies allow for sending SMS text messages which may be scanned from the mobile screen. The ticket is received and it is scanned by the scanner machine at the airport receiving point.

2.3.2 Commerce

It means buying and selling products and services widely, these processes are supported by the availability of M-commerce. E-commerce assists M-commerce; customers may buy from vending machines, pay parking fees by using their mobiles or checking bank accounts and transfer money (Hu, 2005).

2.3.3 Education

Recently mobiles are being used in education, and this process is considered the latest technology in higher education as Levine (2002), McGhee and Kozma (2001) and McKenzie (2005) mentioned.

2.3.4 Enterprise Resource Planning (ERP)

Data accessibility in ERP systems benefits work and makes it more efficient when it is provided in travelling, customers meeting or at other locations Siau (2001) and his research team stated. Providers of ERP systems are trying to find means to offer mobility to users of ERP systems. They try to link employees with their work in a more effective manner by transforming mobile phones and other wireless devices to new tools to exchange information without effort, automate data entry and make transactions anytime and anywhere as Siau and Shen (2003) mentioned, they also said that ERP providers are looking for systems that offer mobility to the users, these systems connect employees to their work effectively, where they can exchange data Varshney (2004), (Wen-Chen Hu, 2014)and(Akamai. 2016 Report)..

2.3.5 Entertainment

The most common application for the young is internet entertainment. M-commerce allowed downloading games, images, music and video and music files whenever and wherever, online games access is easier. Leavitt (2003) predicted that about 80% of the young generation in the U.S. and Western Europe will use mobiles to play games in next few years. Varshney (2004), (Wen-Chen Hu, 2014)and(Akamai. 2016 Report).

2.3.6 Health Care

As industry health care costs are considered high, M-commerce may be helpful in reducing these costs. Doctors and nurses will be able to access patient's records in a click instead of requesting paper records that used to take more time before. Efficacy is the result of using M-commerce by health care providers, it even helps in administrative matters in general as was proved by many scholars such as Larkin (2001), Banitsas (2002), Chau and his research team (2004), Varshney (2004), Rowley (2005) and Bahlman and his colleagues (2005).

2.3.7 Stocktaking and distributing

To know the stocks amount you have and the requests you should meet is critical in maintaining customers in business world nowadays. M-commerce allows businesses to

track storages, make deliveries on time and enhance companies' competitiveness. Some delivery companies such as UPS and FedEx applied M-commerce in their dealings successfully (Wen-Chen Hu, 2014)

2.3.8 Traffic

Traffic control is usually hectic in the cities. The use of M-commerce offers solutions for this problem. Mobiles own a GPS application may help derivers in locating their destination, gives them directions, and tells them about the status of the traffic. Centers of traffic control monitors and controls traffic by signals transferred from individuals mobiles in vehicles Varshney (2004), (Wen-Chen Hu, 2014)and(Akamai. 2016 Report).

2.4 M-commerce Benefits for Individuals and Enterprises

M-commerce availability gives individuals an advantage. M-commerce is spreading more and more every day and its features are becoming more ideal compared with E-commerce as shown in figure 2-2. M-commerce advantages to customers include:

Customized Services. M-commerce offers services based on a specific location upon the interest of the user.

Time-critical Situations. It makes performing tasks more effective regardless of geographical location.

Spontaneous Requirements and Decisions. Buying decisions with small amounts of money do not need careful thinking for instance, in such cases M-commerce is the solution.

Increase of Efficacy. It increases efficacy and productivity in performance. For example, employees may use time-dead spots like when they are traveling to and from workplace more effectively.

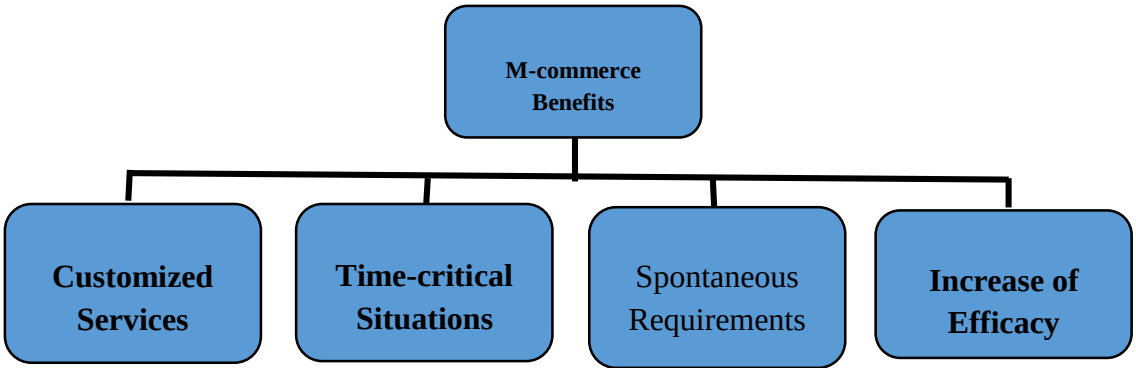


Figure 2-2: M-commerce benefits to customers.

2.5 Mobile Shopping

Transactions across time and geographical location were made possible because of mobiles. Buyers through mobiles should know what are the requirements for buying. Whole lists of shopping might be prepared on the web interface then completed from a mobile. For customers convenience one button should be enough to complete the purchase experience for mobile shopping. Providers of services and products offer customers suggestions based on users past behavior patterns (Perna, 2014) and (Melinda R, 2014).

Payments for purchases are completed by following several methods. The credit cards is one method for payments done via internet, charges of services are billed against the credit card of the buyer. The buyer informs service providers of his credit card number by an interface such as WAP. Another method is the invoice. The buyer registers himself with the provider and receives the invoice, then the amount of the buyer pays manually or by entrusts for the standing order as a direct debit against the buyers' bank account. A third method is prepaid cards.

The buyer buys the prepaid card from the provider, and then the service used by the buyer's side is billed against the prepaid card. A fourth type is paying is conducted by premium SMS, in this type the subscriber sends the SMS to a certain number, this SMS has a fixed cost, and this cost is then collected by the network carrier on behalf of the service provider. (Perna, 2014). A fifth type occurs by the telephone bill. Mobile services are paid through the monthly telephone bill. Mobile payment means payments conducted by mobile devices in order to buy goods and services. This type plays the role of intermediary between the consumer and seller such as "Mobile Wallet" as with "T-Mobile" or the "m-pay" offered by Vodafone. This type combines different characteristics of other paying methods such as the credit cards, prepaid cards, invoicing and telephone bills. In this type both the customer and the seller should be registered with the payment service. Then a PIN is provided to the subscriber, and through the WAP or SMS the subscriber authenticates himself in order to be able to buy and pay. Subscribers benefit from the registration only for one time. The sellers also do not have to worry if the customer's credit worthy. Sellers hope to draw customers interested in using mobiles for paying but are not willing to register with more than one vendor.

Studies proved that mobile payments are reliable and acceptable. One study conducted in Germany at the University of Augsburg and included 4400 participants proved that 80% are willing to accept mobile payment; of that percentage 96% said privacy of personal data is the reason for their decision, in addition to simplicity and the low cost of transactions. Costs present the most important matter in the choice of a certain paying method. More than 37% agreed to use mobile payment if there is no transaction cost, while others agreed

to pay if transactions costs were different. But in general, mobile transactions were preferred for smaller amounts. Therefore, mobile payment methods are paving the way for m-commerce applications.

The top online mobile shopping sites include Amazon.com, Ebay.com, Walmart, Alibaba.com, Target.com, Bestbuy.com, Flipkart.com, ebay.com, Groupon.com and Ikea.com.

2.6 The Best 5 Mobile Applications Used at Shopping Malls Globally

In the past, you would search for a certain product on the internet then to go to the store to buy it. The smart phones and their applications changed the scenario; the emergence of credit cards made smart phones a new essential device for shopaholics. Mobile shopping applications save you time, effort and money. The next few paragraphs identify the best 5 mobile applications used in shopping globally.

2.6.1 AliExpress

AliExpress started as a business-to-business buying and selling portal. It has since expanded to business-to-consumer, consumer-to-consumer, cloud computing, and payment services, as well. The world's leading small business e-commerce company, today formally launched Fulfillment by AliExpress (fulfillment.aliexpress.com), a new logistics and shipping service provided by a third-party partner for buyers using the AliExpress (www.aliexpress.com) wholesale e-commerce platform. With Fulfillment, small businesses using AliExpress will be able to combine multiple orders into one cost-reducing international shipment, track those orders from China-based suppliers using a single online interface, and verify those orders at a central warehouse prior to shipment. International small and medium businesses will be able to save up to 30 percent off their total shipping costs using Fulfillment by AliExpress. This is achieved through bulk shipping deals

and the combining of multiple international shipments from different suppliers into a single shipment for one buyer. Alibaba.com's shipping and logistics partner, GELS Enterprise Shanghai Co Ltd, will handle all warehousing, shipping and logistics for AliExpress orders that choose to use the Fulfillment service, offering a choice of discounted rates from international carriers such as UPS and EMS, with other shipping carriers to be added in the future. "AliExpress was designed to give even the smallest business a competitive global trade advantage by offering better prices on smaller-quantity orders," said David Wei, CEO of Alibaba.com. "Adding the Fulfillment service to the AliExpress platform allows us to further extend the international buying power of small businesses around the world, making the shipping and delivery of their businesscritical goods as easy, safe and convenient as possible." (aliexpress. 2017 Annual Report)

2.6.2 eBay

eBay is a marketplace where millions of people trade every day. Some are buyers, some are sellers, some are both. The beauty of eBay lies in the power of the marketplace - an item is only worth what someone will pay for it (eBay. 2017 Annual Report). Today, eBay is a multi-billion-dollar business with operations in about 30 countries ("Global Trade, 2011) The company manages eBay.com, an online auction and shopping website in which people and businesses buy and sell a wide variety of goods and services worldwide. The website is free to use for buyers, but sellers are charged fees for listing items after a limited number of free listings, and again when those items are sold (DeNardis, Anthony 2017).

2.6.3 Amazon

Amazon.com passed many milestones in 1997: by year-end, we had served more than 1.5 million customers, yielding 838% revenue growth to $147.8 million, and extended our market leadership despite aggressive competitive entry. Today, online commerce saves customers money and precious time. Tomorrow, through personalization, online commerce will accelerate the very process of discovery. Amazon.com uses the Internet to create real value for its customers and, by doing so, hopes to create an enduring franchise, even in established and large markets. We have a window of opportunity as larger players marshal the resources to pursue the online opportunity and as customers, new to purchasing online, are receptive to forming new relationships. The competitive landscape has continued to evolve at a fast pace. Many large players have moved online with credible offerings and have devoted substantial energy and resources to building awareness, traffic, and sales. Amazon is affected by seasonality, which historically has resulted in higher sales volume during our fourth quarter, which ends December 31. We recognized 33%, 33%, and 32% of our annual revenue during the fourth quarter of 2014, 2015, and 2016, (amazon.com, Inc. Form 10-Q, 2017).

2.6.4 Walmart

Walmart is an American multinational retail corporation that operates a chain of hypermarkets, discount department stores, and grocery stores. Headquartered in Bentonville, Arkansas, the company was founded by Sam Walton in 1962 and incorporated on October 31, 1969 (Walmart. 2017 Annual Report).

Wal-Mart Stores, Inc. ("Walmart," the "Company" or "we") helps people around the world save money and live better – anytime and anywhere – in retail stores or through our e-commerce and mobile capabilities. Through innovation, we are striving to create a customer-centric experience that seamlessly integrates digital and physical shopping and saves time for our customers. Physical retail encompasses our brick and mortar presence in each market where we operate. Digital retail is comprised of our e-commerce websites and mobile commerce applications. Each week, we serve over 260 million customers who visit our 11,695 stores under 59 banners in 28 countries and e-commerce websites in 11 countries. With a single discount store and the simple idea of selling more for less, has grown over the last 50 years into the largest retailer in the world. Each week, over 260 million customers and members visit our 11,695 stores under 59 banners in 28 countries and e-commerce websites in 11 countries. With fiscal year 2017 revenue of $485.9 billion, Walmart employs approximately 2.3 million associates worldwide. Walmart continues to be a leader in sustainability, corporate philanthropy and employment opportunity. It's all part of our unwavering commitment to creating opportunities and bringing value to customers and communities around the world (Walmart. 2017 Annual Report).

2.6.5 Best Buy

Best Buy is one of Canada's largest and most successful retailers, operating the Best Buy (www.bestbuy.ca), The Company offers consumers a unique shopping experience with the latest technology and entertainment products, plus an expanded assortment of lifestyle products offered through www.bestbuy.ca, at the right price, with a no-pressure (non-commissioned) sales environment. Best Buy is a leading provider of technology products, services and solutions.

The company offers expert service at an unbeatable price more than 1.5 billion times a year to the consumers, small business owners and educators who visit our stores, engage with Geek Squad Agents or use BestBuy.com or the Best Buy application (Fiscal 2016 Annual Report).

2.7 The Mobile Commerce (M-Commerce)

The term created new opportunities for mobiles and services provided. All the transactions that entails data connecting, performed by a wireless device and included value transfer in return for information, service or product is termed M-commerce. Its' users are growing fast. It is expected that the user's number will exceed the number of stationary terminals around the universe in the next few years. Mobiles services benefit is present in personalization, time-sensitivity, and location awareness. Different wireless and mobile networks adopt M-commerce applications and services. In constructing M-commerce services and application we should consider issues that affect its performance. Users identification requirements and services classification are important factors in M-commerce design.

2.8 Understanding Customers and Intelligent Customers Profiling

In software applications user's profiles include essential information about them. Preferences, interests, background and goals differ between different users in using

software applications. Recognizing the differences is important to offer personalized services. Profiling is the process of obtaining values of deferent properties that constitute the user model. Users' interests from their history are collected, even though the profile remains insufficient for modeling user's behavior. For companies to provide services that have a high-quality profile of user's education, experience and interests is required.

Even the position of the user is important to offer online advertisement and recommendations. Understanding customers assist in providing the targeted group with the proper services, otherwise promoting products becomes difficult. So, matching customers with certain services or products is important (Rajeshri and Prakash2013),(Pramod and Malik, 2011), (Tejal , Atma and Vishal ,2016) and (Anna and Erhan, 2016).

Key themes:

Profiling of customers means to use data or information about users to better understand what they need and their expectations at anytime and anywhere. It is used to help in designing services for customers and to deliver it. But profiling of customers is not only data collection, because the data is already there and only needs synthesizing to useful forms. It is not only understanding of demographic segmentation; it takes a broader range of tools, data and techniques to create a rich understanding of the users. And it is an ongoing journey.

Effective use of customer profiling helps to:

- Produce effective and efficient customized services target resources according to priorities.
- Produce responsive services encouraging and reflecting customer engagement
- Improve services so that customers can get what they need.

2.8.1 Methods for Profiling Customers

Demographic /Geo-Demographic: profile and target individuals by aggregating data and location-based data from offline and online. Such as, the lechers evaluation at the universities.

Transaction Data: which is based on their recent behavior

Where there is a relation between a tracked past purchase and the probability a costumer has the condition you treat.

Explicit: which is defined the new users depend on their explicitly declared profile

Can put as fine a point as needed on your target

Benefits need to be balanced with volume and cost

Contextual: Target ads and messages to users alongside the most relevant content and context

If you have information-motivated consumers and an unlimited supply of high-quality content about the condition (or concomitant condition)

Behavioral: Profile and target users by interest, based on their previous tracked activity

When you have an affinity group that fits-into one of the larger scale cookie-cutter segments

Expect to see innovation in health-customized solutions

Look-Alikes: can define the new customers using modeling the browsing behaviors of actual brand converters.

Infinite possibilities forthcoming for modeling and replicating patients' profile and behavior.

2.8.2 Some of Intelligent Profiling Techniques

In this section will explain some of the Intelligent Profiling Techniques as in (Maaike Fleuren, 2012), (Anna and Erhan, 2016).

Bayesian Networks: are expressive compressed representations of infinity relationships between relevant variables in a certain domain.

Association Rules: is a technique used to look for data to find patterns. Association rules have also been used to find users profiles in different areas such as web usage and e-commerce (Anna and Erhan, 2016).

Case-Based Reasoning: is a technique used to solve new problems by previous similar experiences remembrance.

2.9 Data Mining

Several definitions have been proposed for data mining. One definition sees data mining as the process of analyzing data and discovering algorithms that produce numerical patterns or models over the data under acceptable computational efficiency limitations. Another

definition says data mining is “the induction of understandable models and patterns from databases”. Or, initially have a large collection of possible models and (finite) data. Data Mining results in the models that describe the data in the best way, or the models that is suitable for part of the data, as shown in figure 2-3, (Kumar and Steinbach, 2016).

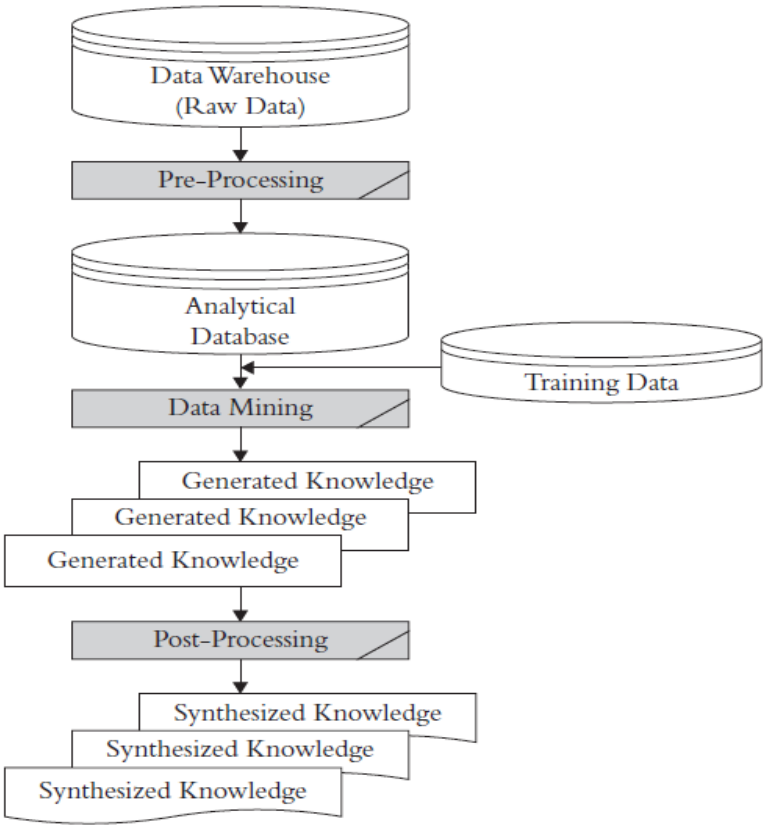


Figure 2-3: Knowledge Discovery Process (Kumar and Steinbach, 2016).

2.9.1 Data Mining Classification Task

The attempt to classify data mining results from exploring newly offered objects characteristics and assigning these objects to their predefined classes. Well defined classes characterize good classification in addition to a training set including pre-classified examples. Data mining task is to construct a model for application on unclassified data to sort it. Classification tasks examples include (Patrick O, 2008) and (Thamilselvan. P and Sathiaseelan. J, 2015).

Classifying applicants based on their credit into low, medium or high.

Classifying mushrooms as edible or poisonous.

Recognizing telephone used for internet access.

2.9.2 Data Mining Clustering Task

Clustering or grouping is creating subgroups that share common features. Clusters do not have predefined classes; it is rather similarity that gathers them. Clustering is a process conducted as a preliminary for a data mining form. Clustering, for instance, can be the first phase in segmenting markets effort, instead of trying to the one-size-fits-all rule used to determine the type of premium promotion for each cluster (Anna and Erhan, 2016).

2.9.3 Data Mining Association Rules Task

Association rule refers to a correlation between groups of objects in a certain database, i.e. the objects either occur together or one implies the other. For example, in a group of farmers if 30% grow wheat and grow pulses; 2% of all farmers grow both wheat and pulses. The 30% is considered confidence and the 2% is the support. Association rules meeting user-specified minimum support and minimum confidence constraints are considered main issues (Anna and Erhan, 2016).

2.9.4 Data Mining Prediction Rules Task

Predictions can be considered a classification or estimation. Data mining is considered a method of classification. Classifying is not expected to be right all the time; uncertainty is attributed to incomplete information. Predictive tasks classification is different because the records are classified based on future behavior prediction

or future value estimation. Time tests confirmation of a certain classification prediction is right. For example, the balance transferred size might be predicted; customer's abandonment in future and which subscribers would order value-added services may be also predicted (Anna and Erhan, 2016).

Classifying and estimation techniques may be used in prediction with known variables. Past data helps in building a model to explain current observed behavior, and then this model is implemented on existing inputs so that future behavior is predicted. Following are some examples of prediction tasks:

If a credit card accepts a transfer the size of the balance to be transferred can be predicted.

The type of customers leaving within a period of 6 months can be predicted.

The telephone subscribers that might order services such as three-way calling or voice mail can be predicted.

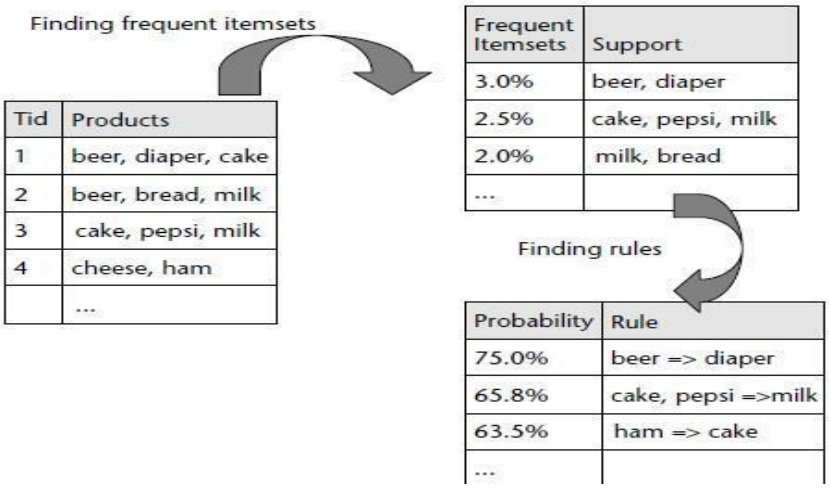
By training examples any classification and estimation technique can be adopted where the value of the variable to be predicted is already known, along with historical data for those examples.

2.9.5 Association Rules (Cross-selling)

Using association rules to analyze the shopping cart of the customers' transactions, teaches us about the products commonly bought together the probability of buying a particular product along with another (Anna and Erhan, 2016).

Association Rules Algorithm Principles:

Principals of the association rules include two algorithm steps, the first is intensive calculation to find sets of the frequent items, and the second is association rules generation depending on frequent item sets.



Tid	Products
1	beer, diaper, cake
2	beer, bread, milk
3	cake, pepsi, milk
4	cheese, ham
	...

Frequent Itemsets	Support
3.0%	beer, diaper
2.5%	cake, pepsi, milk
2.0%	milk, bread
...	

Probability	Rule
75.0%	beer => diaper
65.8%	cake, pepsi =>milk
63.5%	ham => cake
...	

Figure 2-4: The Two-steps of association rules algorithm.

Concepts of Association Rules Algorithm:

Item set

Is a set of items of certain products, each one includes a number of items which determines its size.

Item set A has a one item that means (size (A) =1).

Support

The support an item set (A, and B) is build up of from transactions total number that include A and B.

Support is defined by the following formula:

Support ({A, B}) = NumberOfTransactions (A, B)

A Minimum Support stands for the threshold parameter which should be specified, it means being interested only in the item sets that represent at least minimum support of the dataset.

Probability (Confidence)

In data mining the probability is termed confidence, and the following formula defines it as:

Probability (A => B) = Support (A, B)/ Support (A)

Probability ({A, B}) = NumberOfTransactions (A, B)/TotalNumberofTransactions

A Minimum Probability means that the threshold parameter that should be specified and we are interested only high probability rules instead of minimum probability.

Importance

We can call importance as the interesting score of the lift and it used to measure item sets and rules.

It is defined as formula:

Importance ({A, B}) = Probability (A, B)/ (Probability (A)* Probability (B))

 If importance = 1, A and B are independent items.

 If importance is < 1, A and B are negatively correlated, this means if a customer buys A it is unlikely he will also buy B.

 If importance is > 1, A and B are positively correlated, this means if a customer buys A, it is very likely that he will also buy B.

The following formula means:

Importance (A => B) = log (p (B|A)/p (B| not A))

The 0 importance means no association between A and B.

The B probability increases if A is true, indicating a positive importance score.

The B probability decreases if A is true, indicating a negative importance score.

For example:

	Dont	Not Dont	Total
Muffin	15	5	20
Not muffin	75	5	80
Total	90	10	100

Support ({Donut}) = 90

Support ({Muffin}) = 20

Support ({Donut, Muffin}) = 15

Probability ({Donut}) = 90/100 = 0.9

Probability ({Muffin}) = 20/100 = 0.2

Probability ({Donut, Muffin}) = 15/100 = 0.15

Probability (Donut|Muffin) = 15/20 = 0.75

Probability (Muffin|Donut) = 15/90 = 0.167

Importance ({Donut, Muffin}) = 0.15/ (0.2*0.9) = 0.833

Importance (Muffin=>Donut) = ln (Probability (Donut|Muffin) /Probability (Donut|Not Muffin)) = ln (0.8) = -0.223

Importance (Donut=>Muffin) = ln (Probability (Muffin|Donut)/Probability (Muffin| Not Donut)) = ln (0.33) = -1.100

In the previous formula the Donut and Muffin are negatively correlated.

The customers buying a Donut are unlikely to buy a Muffin.

The Frequent Item sets:

In frequent item sets the frequency threshold should be specified using Minimum-Support Parameter, for example, Minimum-Support = 3%. This means being interested in the items that appears in at least 3% of all shopping carts.

First, the algorithm finds all frequent item sets with (Size = 1) by counting the support of each individual item.

Then it generates a set of candidate item sets of (size 2) based on the result of first iteration.

Second, it finds the frequent item sets of (size = 2).

The algorithm scans datasets and counts the support of each generated candidate item set.

Finally, it selects the candidates whose support score is more than the Minimum Support to obtain a list of the frequent item sets (size=2).

The algorithm repeats the same procedure for item sets sizes (3, 4, 5….) until no more item sets meet the Minimum Support criteria.

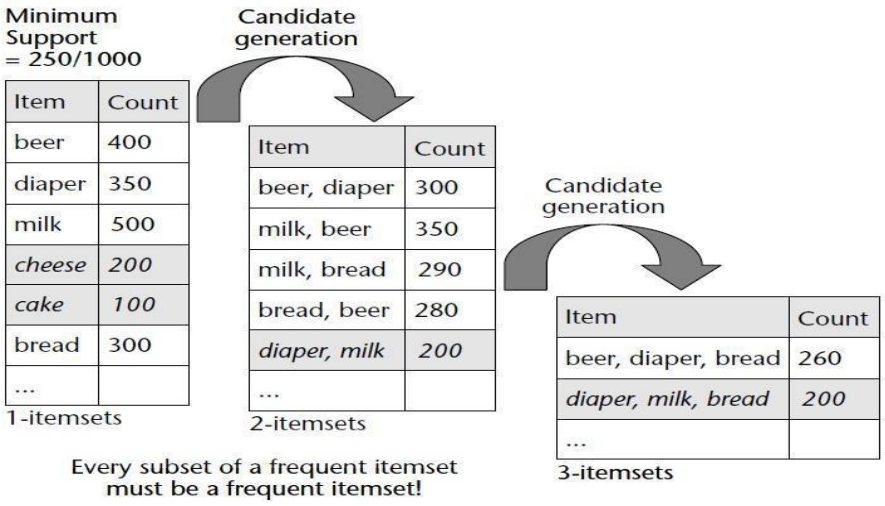


Figure 2-5: Finding Frequent Items.

Prediction:

Finding item sets and rules is the goal of many association algorithms in commercial data mining packages. Association Algorithm predicts using rules, results are a set of items to recommend.

Association Rules Algorithm parameters:

Microsoft association rules algorithm parameters are listed in the following:

Minimum- Support: as being explained previously.

Maximum_ Support: Is a threshold used for the filtration of frequented items.

Minimum_Probability: as being explained previously.

Minimum_Importance: Is a threshold used to filter out rules with importance less than it.

Maximum_Itemset_Size: Is a threshold used to filter out item sets that have a size more than it.

Minimum_Itemset_Size: Is a threshold used to filter out item sets that have a size less than it.

Maximum_Itemset_Count: Is a threshold used to specify the maximum number of item sets selected, it avoids generation large numbers of item sets.

Optimized_Prediction_Count: Is a threshold used to prepare count of the recommended items requested by query predication. The increased number leads to better quality predictions.

This algorithm implemented in this e-commerce website using DMX Queries (we will discuss it later) in SQL server 2008 Analysis Services.

2.9.6 Decision Tree – Classification

The name explains the method. Datasets are classified by breaking them into smaller subsets while parallels developing the association tree. Terms associated with the decision tree are “decision nodes” (e.g. Outlook), these nodes have two or more branches (e.g. Sunny, Overcast and Rainy). Leaf nodes (e.g. Play) which represents a classification or a decision. Root node the top decision node in the tree that correspond with the best predictor. The application suits numerical and categorical data (Anna and Erhan, 2016) .

A decision tree best algorithm is the one proposed by J. R. Quinlan and termed ID3, it searches from top and down over the possible branches without backtracking. ID3 uses Entropy and Information Gain to construct a decision tree. But, the Entropy is constructed from top to bottom from a root node and includes similar (homogeneous) value data segmentation data into subsets, as shown in figure 2-6. Entropy is used to calculate homogeneity of a sample in ID3 algorithm. It scores zero is the sample is totally homogeneous and one if it is equally divided (Anna and Erhan, 2016).

Figure 2-6: Decision Trees Example.

In constructing a decision tree, two types of entropy using frequency tables are calculated as follows:

Entropy using the frequency table of one attribute:

$$E(S) = \sum_{i=1}^{e} -\rho i \ \log_2 pi \qquad (2-1)$$

Play Golf	
yes	no
9	5

Entropy(PlayGolf) = Entropy (5,9)

Entropy using the frequency table of two attributes:

$$E(T, X) = \sum_{c \epsilon x} \boldsymbol{P}(\boldsymbol{c}) \boldsymbol{E}(\boldsymbol{c}) \qquad (2-2)$$

		Play Golf		
		Yes	NO	
Outlook	Sunny	3	2	5
	Overcast	4	0	4
	Rainy	2	3	5

E(PlayGolf, outlook) = P(Sunny)*E(3,2) + P(Overcast)*E(4,0) + P(Rainy) *E(2.3)

=(5/14)*0.971 + (4/14)*0.0 + (5/14)*0.971

= 0.693

Information Gain:

Decrease of entropy after splitting the dataset into attributes forms information. Decision tree construction means finding attributes that return the highest information gain (i.e., the most homogeneous branches).

Step 1: Calculate entropy of the target.

Entropy(playGolf) = Entropy(5,9)

= Entropy (0.36,0.64)

$$= - (0.36 \log_2 0.36) – (0.46 \log_2 0.64)$$

= 0.94

Step 2: The dataset is split, after step 1 is conducted, intp different attributes. Each branch entropy is calculated. Then it is added proportionally, to get total entropy for the split. The resulted entropy is deducted from the entropy before the split. Information Gain results or decrease in entropy happens.

		Play Golf	
		Yes	NO
Outlook	Sunny	3	2
	Overcast	4	0
	Rainy	2	3
Gain =0.247			

		Play Golf	
		Yes	NO
Outlook	Hot	2	2
	Mild	4	2
	Cool	3	1
Gain =0.029			

		Play Golf	
		Yes	NO
Humidity	High	3	4
	Normal	6	1
Gain =0.152			

		Play Golf	
		Yes	NO
Windy	False	6	2
	True	3	3
Gain =0.048			

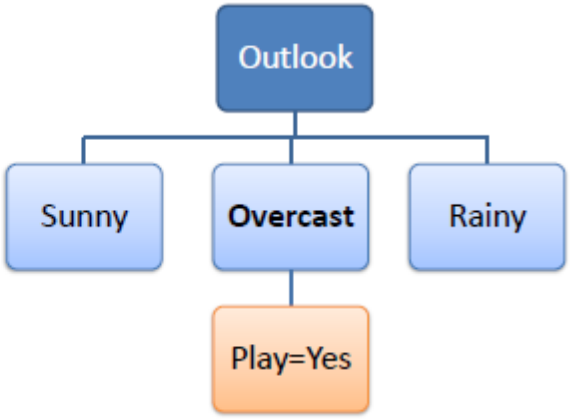
Gain (T,X) = Entropy (T) - Entropy (T, X) $(2-3)$

Step 3: an attribute with the largest information gain as the decision node is chosen.

★		Play Golf	
		Yes	NO
Outlook	Sunny	3	2
	Overcast	4	0
	Rainy	2	3
Gain =0.247			

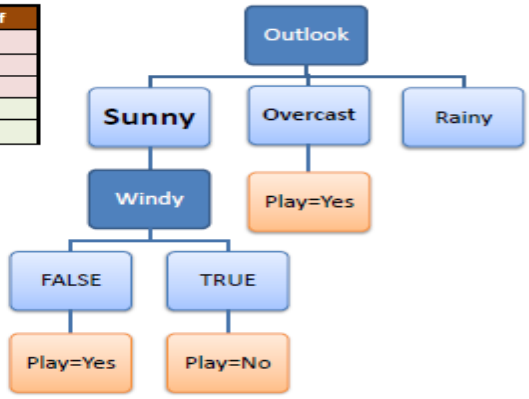
Step 4a: A branch with entropy of 0 is a leaf node.

Temp	Humidity	Windy	Play Golf
Hot	High	FALSE	Yes
Cool	Normal	TRUE	Yes
Mild	High	TRUE	Yes
Hot	Normal	FALSE	Yes
Hot	High	FALSE	Yes



Step 4b: A branch with entropy more than 0 needs further splitting.

Temp	Humidity	Windy	Play Golf
Mild	High	FALSE	Yes
Cool	Normal	FALSE	Yes
Mild	Normal	FALSE	Yes
Cool	Normal	TRUE	No
Mild	High	TRUE	No



Step 5: The ID3 algorithm is run recursively on the non-leaf branches, until all data is classified.

Decision Tree to Decision Rules:

A decision tree can be transformed into a set of rules by mapping from the root node to the leaf nodes one by one (Anna and Erhan, 2016).

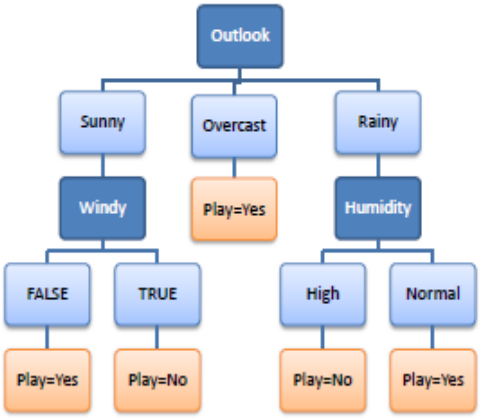
R_1: IF (Outlook=Sunny) AND (Windy=FALSE) THEN Play=Yes

R_2: IF (Outlook=Sunny) AND (Windy=TRUE) THEN Play=No

R_3: IF (Outlook=Overcast) THEN Play=Yes

R_4: IF (Outlook=Rainy) AND (Humidity=High) THEN Play=No

R_5: IF (Outlook=Rain) AND (Humidity=Normal) THEN Play=Yes



Decision Trees – properties: decision trees works with continuous attributes (binning), Super Attributes (attributes with many values), and with missing values.

2.10 Machine Learning

Machine learning is a process of adjusting the "modeling system" parameters behavior to resemble a "system to model" behavior. The learning process system model can be formulated, based on behavior input-output pairs, to give similar outputs for the input just like the original system. As discussed above the he previous requirement will be expressed as: "If a function φ (x) which means the system to model. Furthermore, the f (x, p) means the modeling system, where x∈X is refer into input vector and p is refer into the adjustable parameter vector (Imre J., János F, 2009).

$$\forall x \in X: \emptyset(x) \approx f(x,p) \qquad (2-4)$$

Learning occurs through the use of a set of training samples (input output pairs) in controlled cases. If the number of samples is m, the input in the ith sample is xi, the desired output is di = φ (xi) and the output of the model is yi = f (xi, p), the following formula can be used:

$$\forall i \in [1,m]: di \approx yi \qquad (2-5)$$

The error (ε) shows similarity between the modeling system and the system to model. It is the function of the parameter vector, so it can be depend of (ε P), let us used a widely applied definition for the error, the Mean of Squared Error (MSE), which is often used to define errors:

$$\varepsilon(\mathrm{p}) = \frac{\sum_{i=1}^{m}(di - yi)^2}{m} \qquad (2-6)$$

Minimizing ε function is managed by optimization algorithms. This way Machine learning can be traced back to optimization problem, furthermore, can be applied to discover the efficiency of the memetic algorithm (Imre J., János F, 2009).

2.10.1 The Fuzzy Rule Learning Problem

Fuzzy rule learning problems design needs performing of several tasks in a real application. Obtaining a proper KB of a problem being solved. Researchers developed automated techniques to form fuzzy rules. Input-output data sets are considered the base for fuzzy rules formulating (Imre J., János F, 2009).

$$E = \{e1, \ldots\ldots, eN\} \quad e1 = \{x_1^1, \ldots\ldots, x_n^1, y^1\} \qquad (2-7)$$

The input and output of primary fuzzy petitions and DB definition composes the behavior of the problem being solved. E-malls have symmetrical fuzzy partitions with a number of

triangular membership functions crossing at height 0.5 (by consideration). Therefore, the fuzzy role learning problem is limited to get rules combining the previous labels and assign a specific consequent to each previous combination (Imre J., János F, 2009). (Eyke H, 2009)..

2.10.2 Ant Colony Optimization (ACO) Algorithms for Learning Fuzzy Rules

The procedure of applying ACO algorithms to a specific problem goes through the following (Jorge Casillas and etc,2005), (Chia-Feng J , 2015):

Firstly, get a problem representation as a “graph” or a “similar structure”, which simply covered by ants.

And then will define the way of obtain a “heuristic preference”, that to each choice that the ant colony optimization has to do in every step to create the optimal solution.

Furthermore, will establish an appropriate way of initializing the pheromone and the will define a “fitness function” to be optimized.

At the end will select an ant colony optimization algorithm and apply it to the problem directly.

2.11 E-Commerce Security (SSL)

Customers trust is hard to gain in E-commerce, operators work hard to build it by providing e-security for networks, because customers are constantly demanding for a safe and secure site to handle their business processes, as shown in table 2-2. Protocols are implemented for the purpose of security and trust in commerce such as Secure Socket Layers (SSL) and Secure Electronic Transactions (SET) protocols (Neetu and Vijay 2015).

Table 2-2: E-Commerce Security Dimensions.

CUSTOMER AND MERCHANT PERSPECTIVES ON THE DIFFERENT DIMENSIONS OF E-COMMERCE SECURITY

DIMENSIONS	CUSTOMER'S PERSPECTIVE	MERCHANT'S PERSPECTIVE
Integrity	Has information I transmit or receive been altered?	Has data on the site been altered without authorization? Is data being received from customers valid?
Nonrepudiation	Can a party to an action with me later deny taking the action?	Can a customer deny ordering products?
Authenticity	Who am I dealing with? How can I be assured that the person or entity is who they claim to be?	What is the real identity of the customer?
Confidentiality	Can someone other than the intended recipient read my messages?	Are messages or confidential data accessible to anyone other than those authorized to view them?
Privacy	Can I control the use of information about myself transmitted to an e-commerce merchant?	What use, if any, can be made of personal data collected as part of an e-commerce transaction? Is the personal information of customers being used in an unauthorized manner?
Availability	Can I get access to the site?	Is the site operational?

Digital certificates and Digital signatures are used principles to authenticate parties using shared network. Nevertheless, threats to networks occur based on actual attacker or technological failure (Das ML and Samdaria N , 2014).

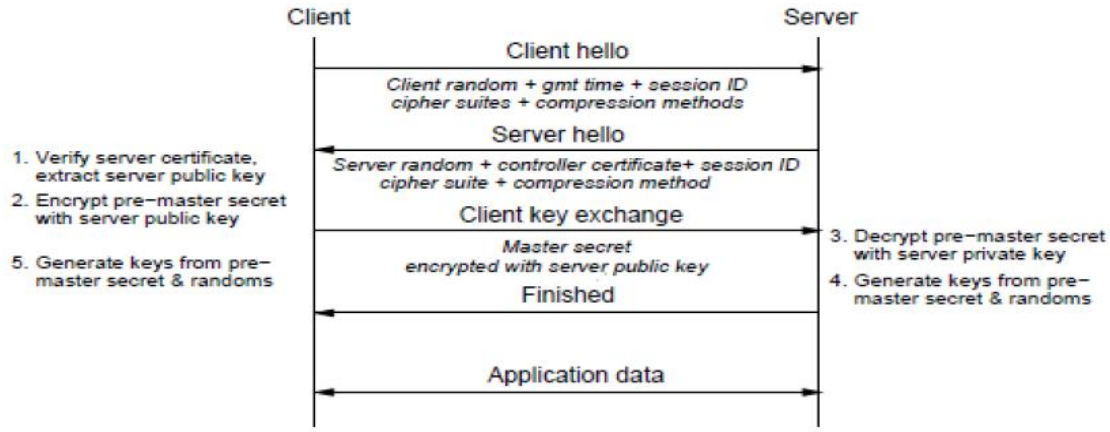


Figure 2-7: Message Flow in Handshake SSL Protocol.

As shown in figure 2-7, All the data of the E-mall system between server and android mobile client will use secure HTTP protocol (HTTPS) to insure security, data integrity, confidentiality, and authenticity with SSL registered certificate for all users' data and online transactions (Machhout M, 2017).

Chapter 3
System Analysis and Design

Introduction

In this chapter, discussed about the main information of the proposed system, which is called “An Intelligent E-mall System using Fuzzy Algorithm and Data Mining over Android Mobile Application”, Starting with the overall system and hardware and software requirements that used to implement that proposed work.

3.1 The Overall Scenario for Profile Building in the Proposed System

The proposed system combines the traditional data mining models on users’ orders and the mining on users’ profiles so it get benefits of all the available knowledge base as shown in figure 3.1.

3.1.1 E-mall Data Mining Model

E-mall combines the traditional data mining models on users’ orders and the mining on users’ profiles so it get benefits of all the available knowledge base. For example: As shown in Figure 3-1, when applying the clustering algorithm on users’ profiles table with the users’ orders table, the result will be (Recommendations). As well as, when applying the association algorithm on orders table, the result will predict what the user like taking consideration of the users’ profiles and their previous orders recommendations, as shown in the Figure 3-2. Finally, in Figure 3-3, when applying the association algorithm on orders table, the result will show the top pairs of soled products for sellers.

Figure 3-1: the proposed system of Data Mining Model for Recommendation.

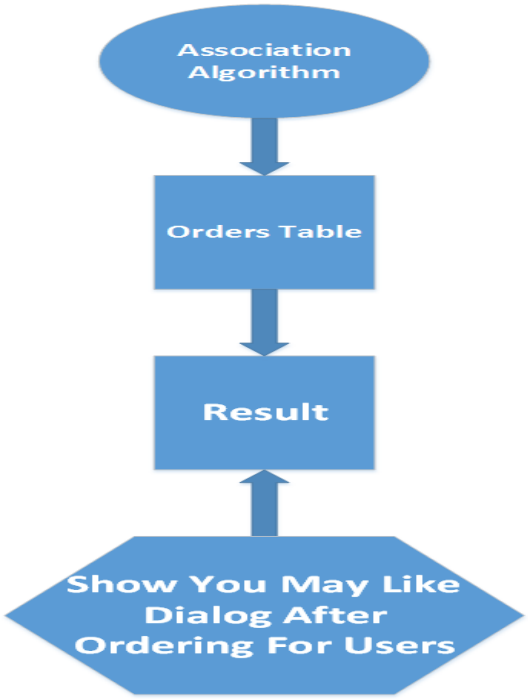


Figure 3-2: The proposed system of data mining model for you may like dialog.

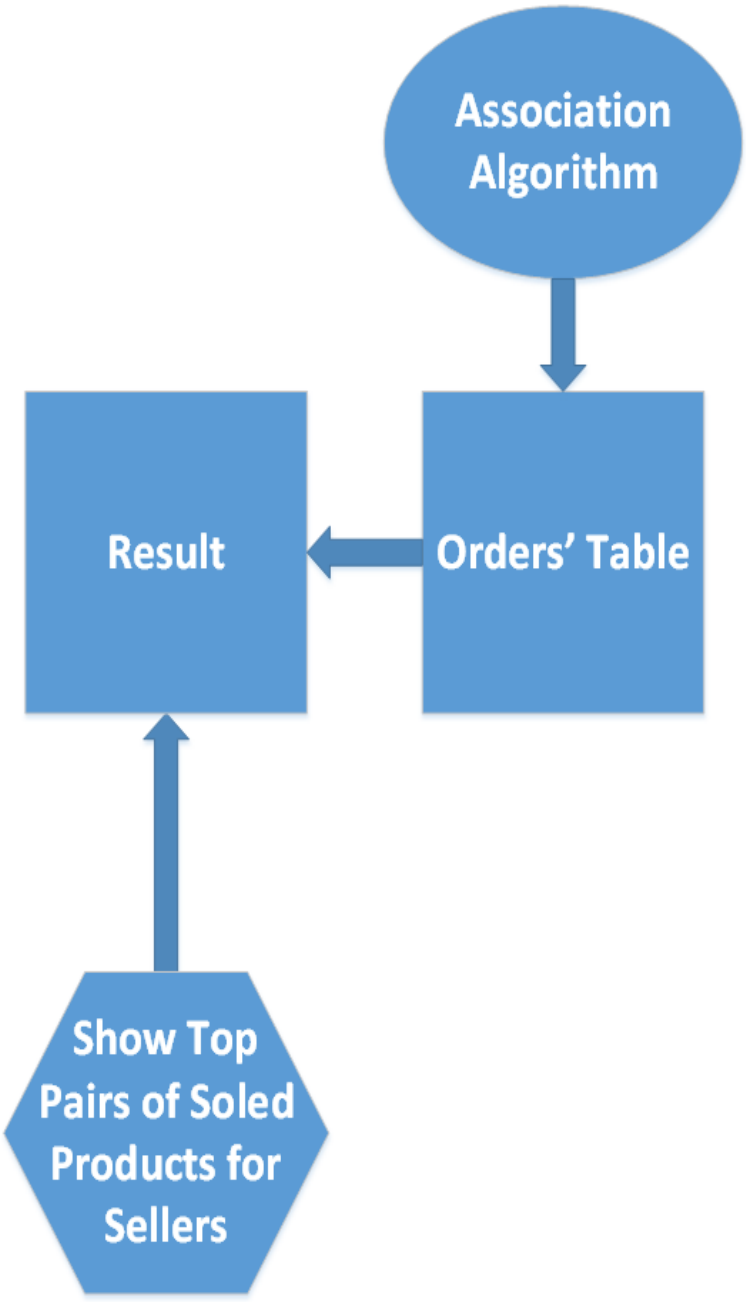


Figure 3-3: The proposed system of data mining model for sellers' reports.

3.2 Proposed system used an E-Commerce Advanced Search

Every effective E-Commerce system must implement advanced search which save users time and effort in the process of searching among the system data. Also, can be used in a smart way to increase profits and efficiency through the presentation of all with regard to the word the user want to search for in the search results. For this reason E-mall system is using Porter's algorithm for word stemming in the search process.

3.2.1 The Proposed system Stemming (Porter Stemmer Algorithm)

Porter stemmer is making use of linguistic analysis to get to the root form of a word. Search engines that use stemming compare the root forms of the search terms to the documents in its database. For example, if the user enters "viewer" as the query, the search engine reduces the word to its root ("view") and returns all documents containing the root - like documents containing view, viewer, viewing, preview, review etc.

The Porter stemming algorithm (or ‘Porter stemmer’) is a process for removing the commoner morphological and inflexion endings from words in English. Its main use is as part of a term normalization process that is usually done when setting up Information Retrieval systems. E-mall is using Porter stemmer for advanced searching over products (information) and stores (information), also for sellers search in orders (information).

3.3 Thesis Management

The research methodology used is the Unified Process (UP) that consists of five independent phases as shown in figure 3.4.

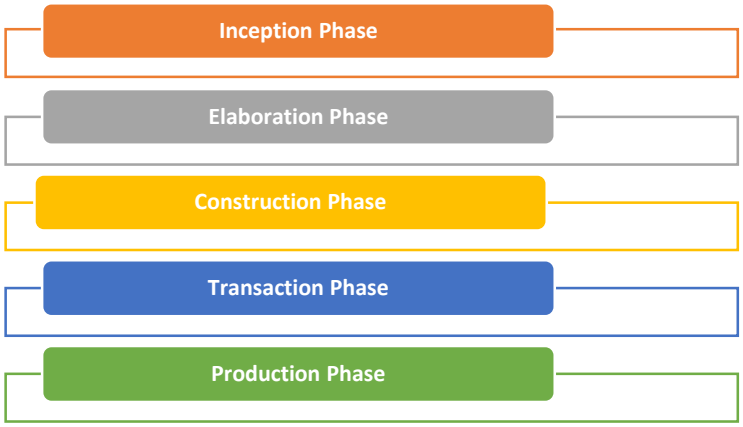


Figure 3-4: The five independent phases.

The Unified Process is an iterative and incremental development process. The Elaboration, Construction and Transition phases are divided into a series of time boxed iterations. (The Inception phase may also be divided into iterations for a large thesis.) Each iteration results in an increment, which is a release of the system that contains added or improved functionality compared with the previous release.

3.4 System Design

In this section will discuss about the user case diagrams, narrative diagrams, sequence diagrams, some of website server sequence diagrams, website server data flow diagram, activity diagrams, some of website activity diagrams, class diagrams and the ERD diagram.

3.4.1 Use Case Diagrams

In this section will discuss about the android user case diagram and server website use case diagram, as shown below in the following subsection.

3.4.1.1 Android Use Case Diagram

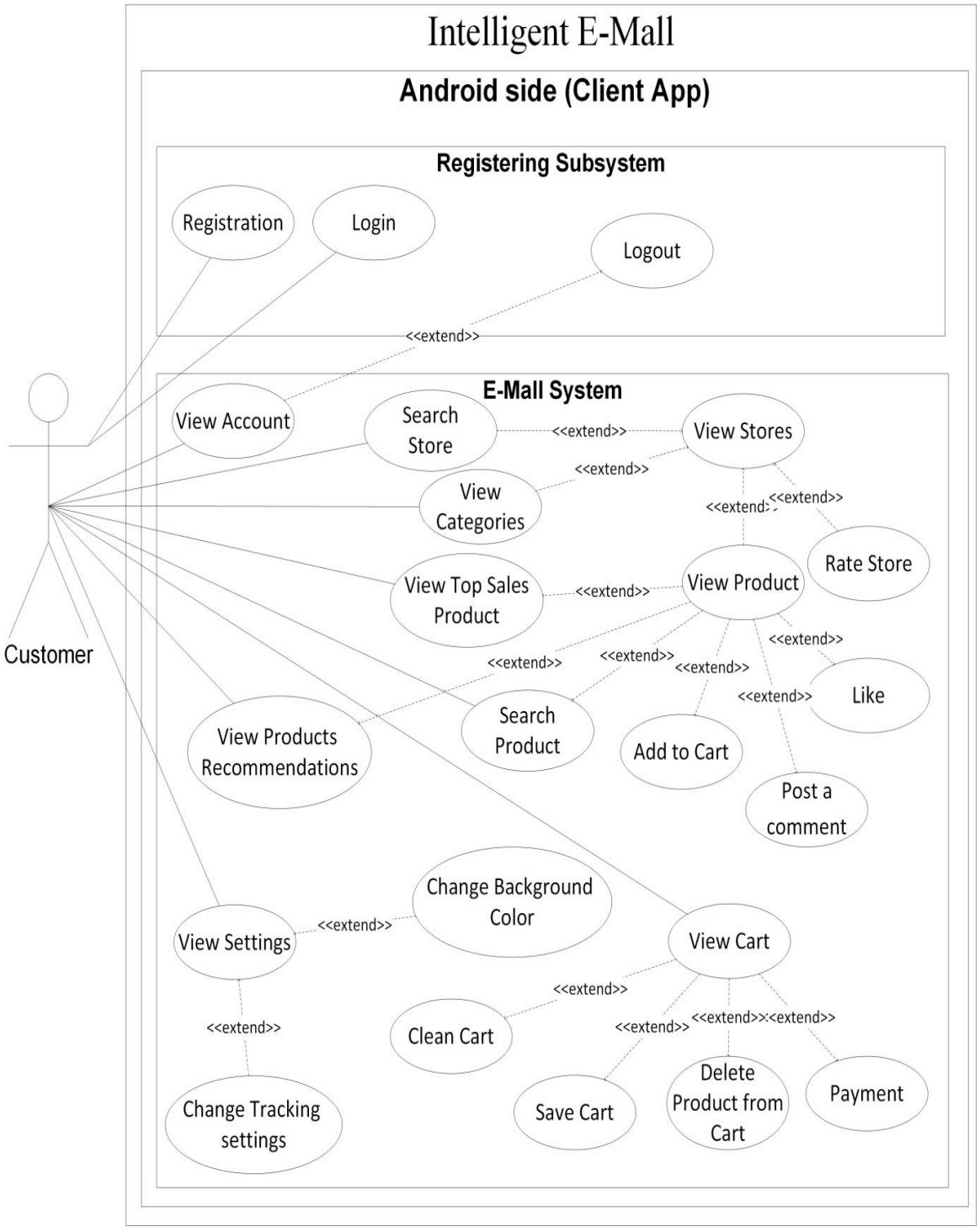


Figure 3-5: Android Use Case Diagram.

Server Website Use Case Diagram

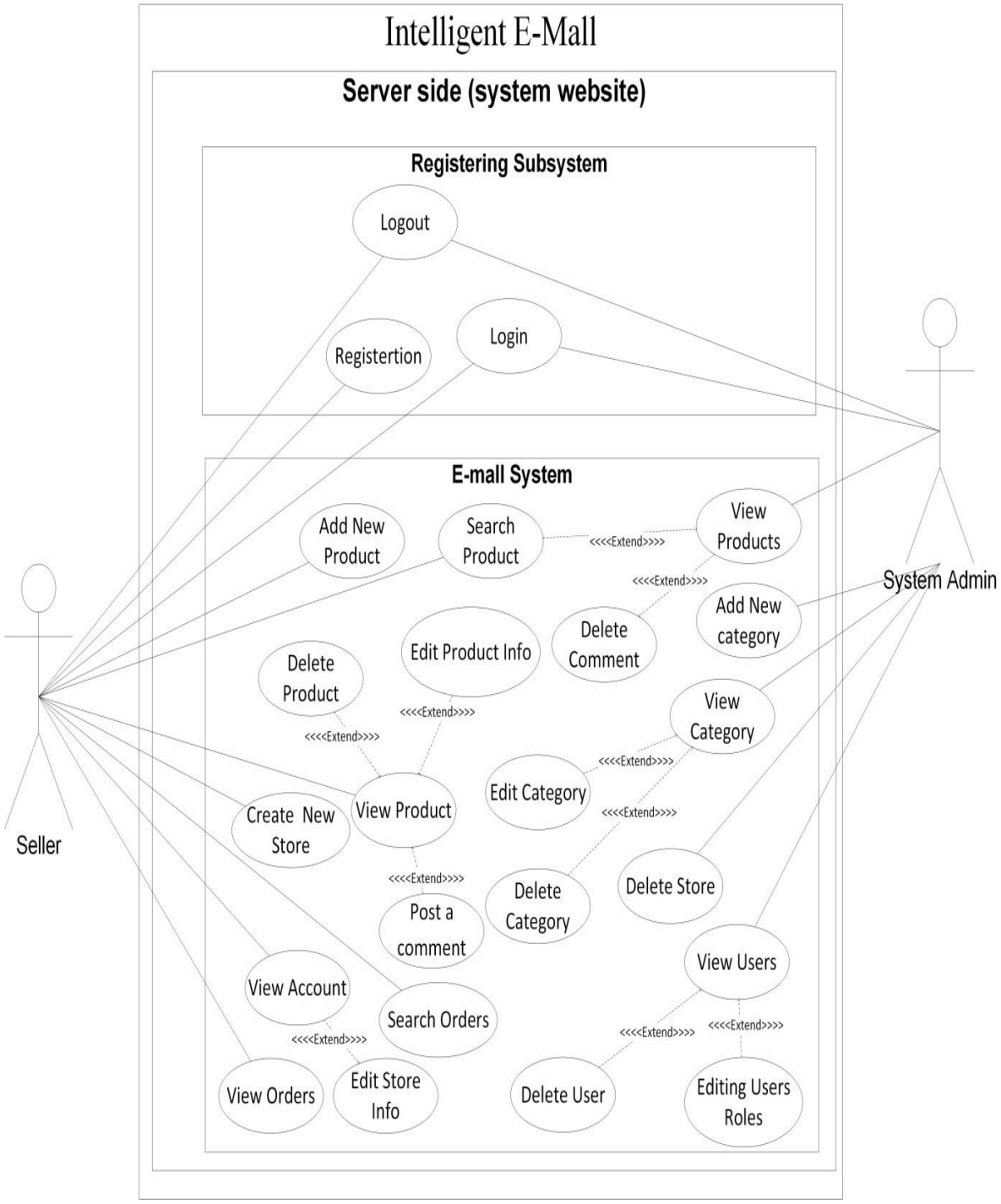


Figure 3-6: Server Website Use Case

3.4.2 Narrative Diagrams.

In this section will discuss about the client narrative tables (android application) and server narrative tables (website), as shown below in the following subsection.

3.4.2.1 Client Narrative Tables (Android application)

Table 3-1: Android Payment Narrative.

Actors:	Customer.
Description:	This use case allows the Customer to pay for his cart.
Preconditions:	The customer must be logged in, the cart mustn't be empty, and the user's credit cart must be valid.

Normal Flow:	1. The customer open the “my cart” interface. 2. The system responds by viewing an interface of all products added to the cart. 3. The customer click on the payment button. 4. The system responds by viewing an interface for entering credit card information. 5. The user insert his credit card information and click on submit button. 6. The system verifies the credit card information. 7. The system saves the order to the server database. 8. The system responds by viewing “payment done” dialog.
Post conditions:	The system clears the shopping cart.
Alternative Flows:	The system show an error toast if the payment operation failed.
Priority:	High.
Frequency of Use:	Depends on the customer.
Business Rules:	None.

Table 3-2: Android save Cart Narrative.

Actors:	Customer.
Description:	This use case allows the Customer to save his cart to the server.
Preconditions:	The customer must be logged in, There is a product in the customer shopping cart and not saved, or there is an update on saved cart.
Normal Flow:	The customer open the “my cart” interface. The system responds by viewing an interface of all products added to the cart. The customer click on the save button. The system saves the order to the server database. The system show “saving done” toast.
Post conditions:	The system disable the save button until a new change.

Alternative Flows:	The system show an error toast if the save operation failed.
Priority:	Normal.
Frequency of Use:	Depends on the customer.
Business Rules:	None.

Table 3-3: Android Add to Cart Narrative.

Actors:	Customer.
Description:	This use case allows the Customer to add products to his cart.
Preconditions:	The customer must be logged in.
Normal Flow:	The customer selects a product. The system responds by viewing interface of all product information. The customer select the “add to cart” button. The system responds by viewing an interface for ordering. The customer insert the required quantity. The customer submit the order. The system responds by add the new order to the customer’s shopping cart. The system responds by viewing an interface of “you may like” products.
Post conditions:	Customer must be logged in. Product has comments to delete.

Alternative Flows:	If the product's quantity out of store, THEN the order canceled.
Priority:	Normal.
Frequency of Use:	Depends on the customer.
Business Rules:	None.

3.4.2.2 Server Narrative Tables (website)

Table 3-4: Website Delete Comment Narrative.

Actors:	Administrator.
Description:	This use case allows the Admin to delete comments from the products' comments list.
Preconditions:	The administrator must be logged in.
Normal Flow:	The administrator open the stores page. The system responds by viewing interface of all stores.

	The administrator select a store. The system responds by viewing interface of all products. The administrator select a product. The system responds by viewing interface of all comments on the product. The administrator delete a comment. The system delete the comment from the database.
Post conditions:	Administrator must be logged in. Product has comments to delete.
Alternative Flows:	None.
Priority:	Normal.
Frequency of Use:	None.

Table 3-5: Website Edit User Role Narrative.

Actors:	Administrator.
Description:	This use case allows administrator to edit user role [user, seller].
Preconditions:	The administrator must be logged in.
Normal Flow:	The administrator open the users' page. The administrator choose the user name. The administrator choose new role for the user and submit it. The system change and store the role of the user in database
Post conditions:	The user must be registered by the website.
Alternative Flows:	None.
Priority:	High.
Frequency of Use:	Depends on the new sellers join the system.

Table 3-6: Website Add New Product Narrative.

Actors:	Seller.
Description:	This use case allows the seller to add new products to his store.
Preconditions:	The seller must be logged in.
Normal Flow:	1. The seller open the products page. 2. The seller click on add new product from products list. 3. The system show the add product Form to allow the seller to fill in the product information 4. The seller fill in the form with product information and click on add button. 5. The system save the new product information to the database.
Post conditions:	The product will be added to the store products.
Alternative Flows:	None.
Priority:	Normal.
Frequency of Use:	Depends on the seller.

3.4.3 Sequence Diagrams

In this section will discuss sequence diagrams, which include the mobile android sequence diagrams, such as login, payment and view product sequence diagram and some of website server sequence diagrams, such as view product and post a comment, user registration and search for order sequence diagram as shown below in the following subsection.

3.4.3.1 Some of Android Sequence Diagrams

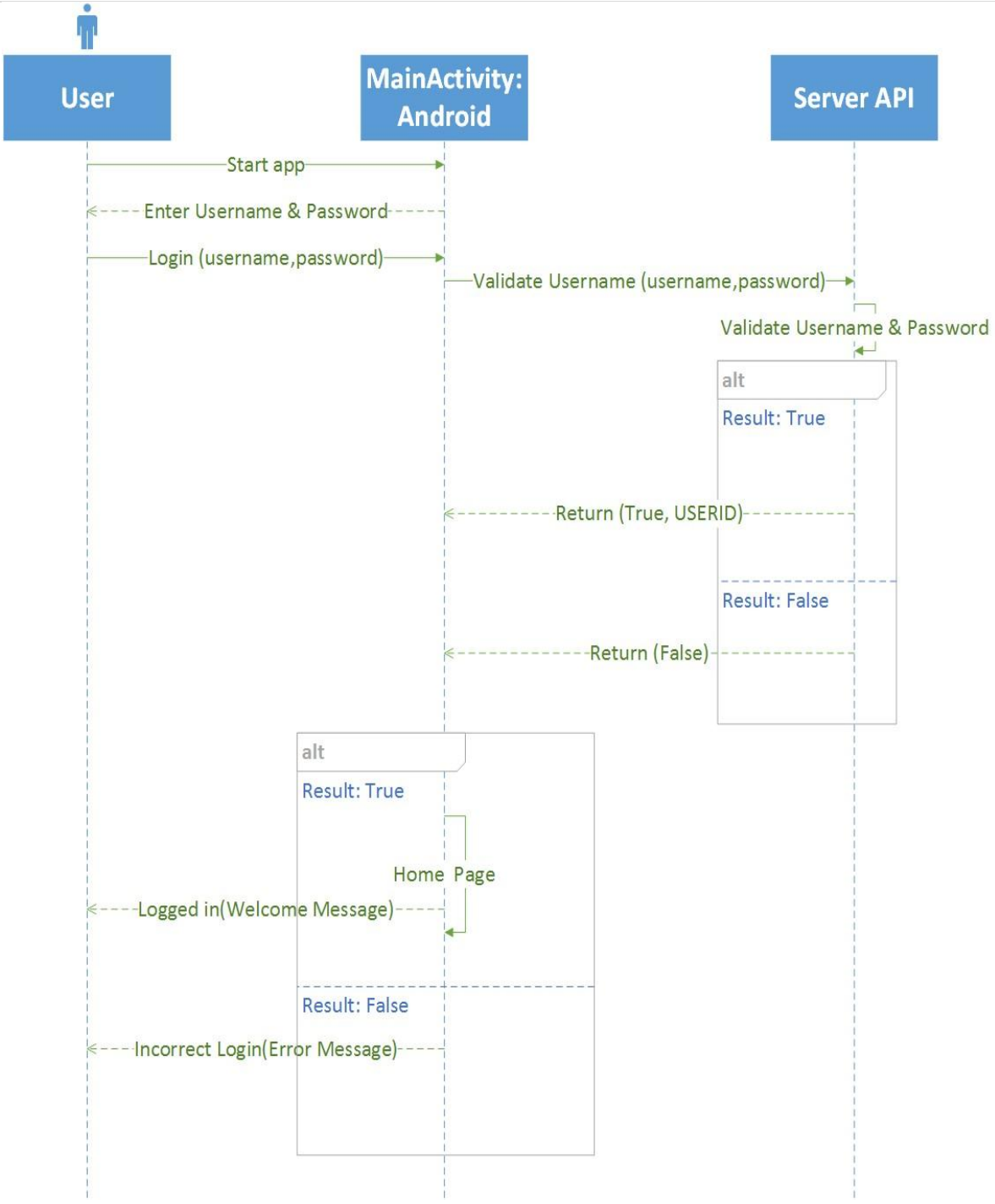


Figure 3-7: Android Login Sequence Diagram.

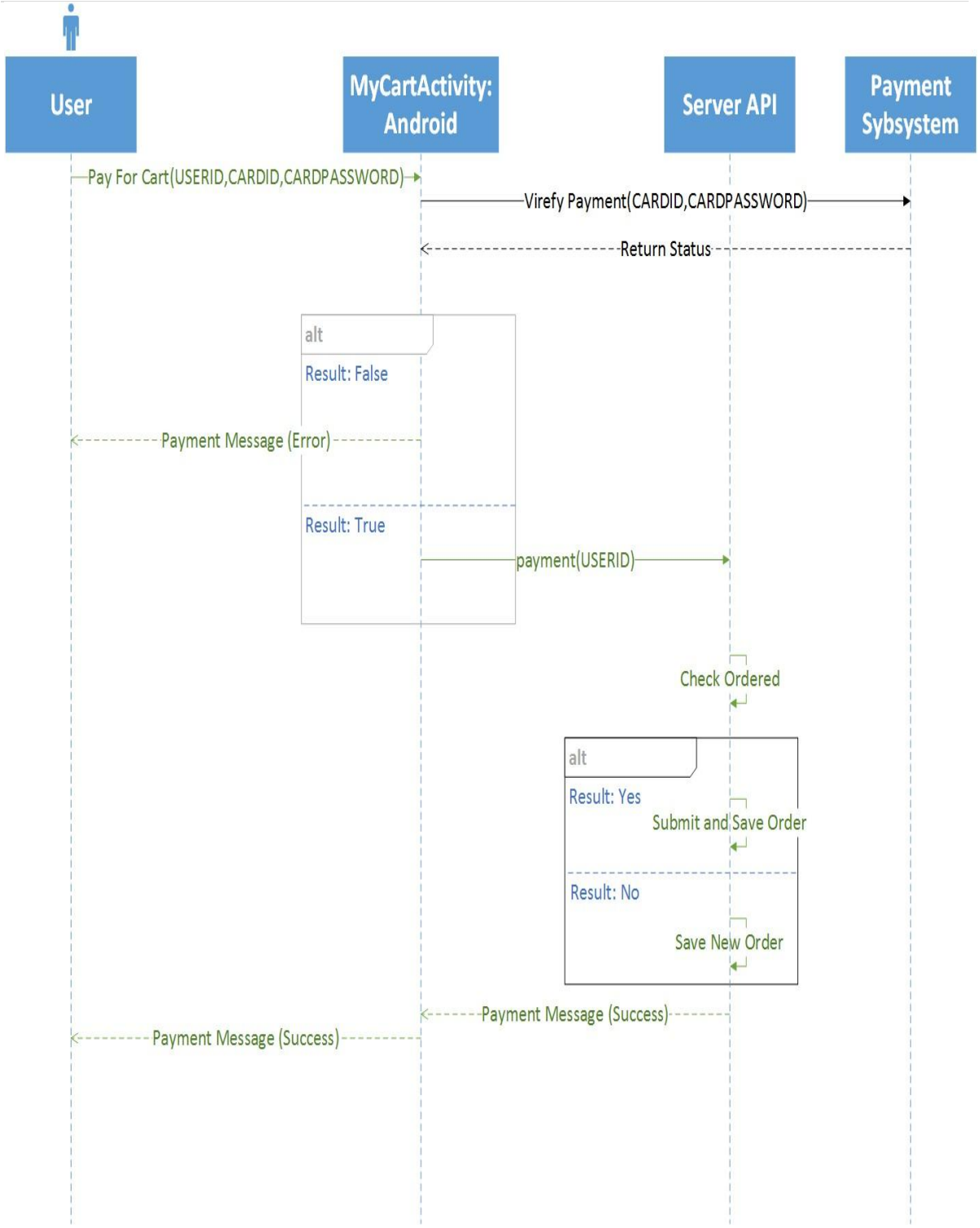


Figure 3-8: Android Payment Sequence Diagram.

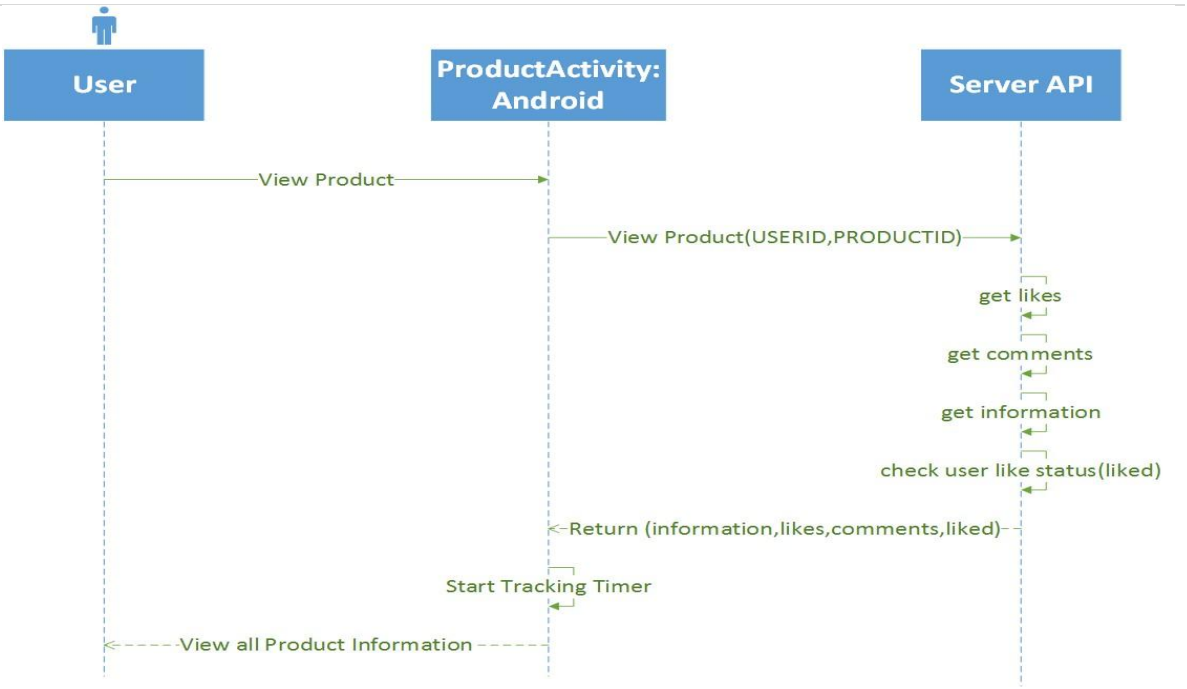


Figure 3-9: Android View Product Sequence Diagram.

3.4.3.2 Some of Website Server Sequence Diagrams

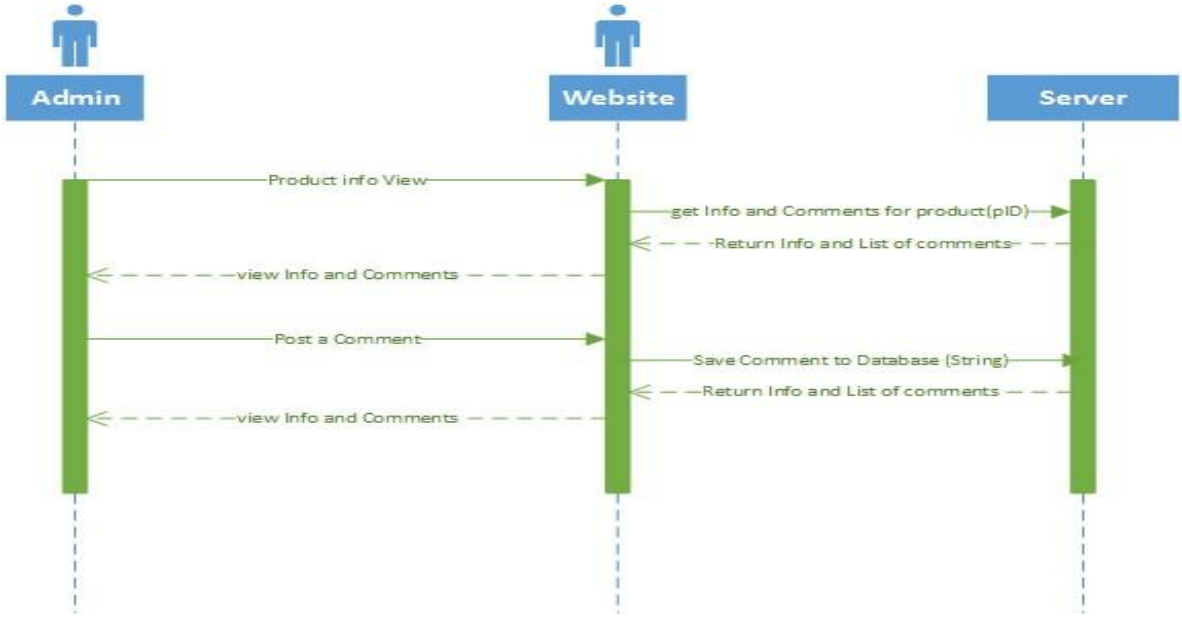


Figure 3-10: View Product and Post a Comment Sequence Diagram.

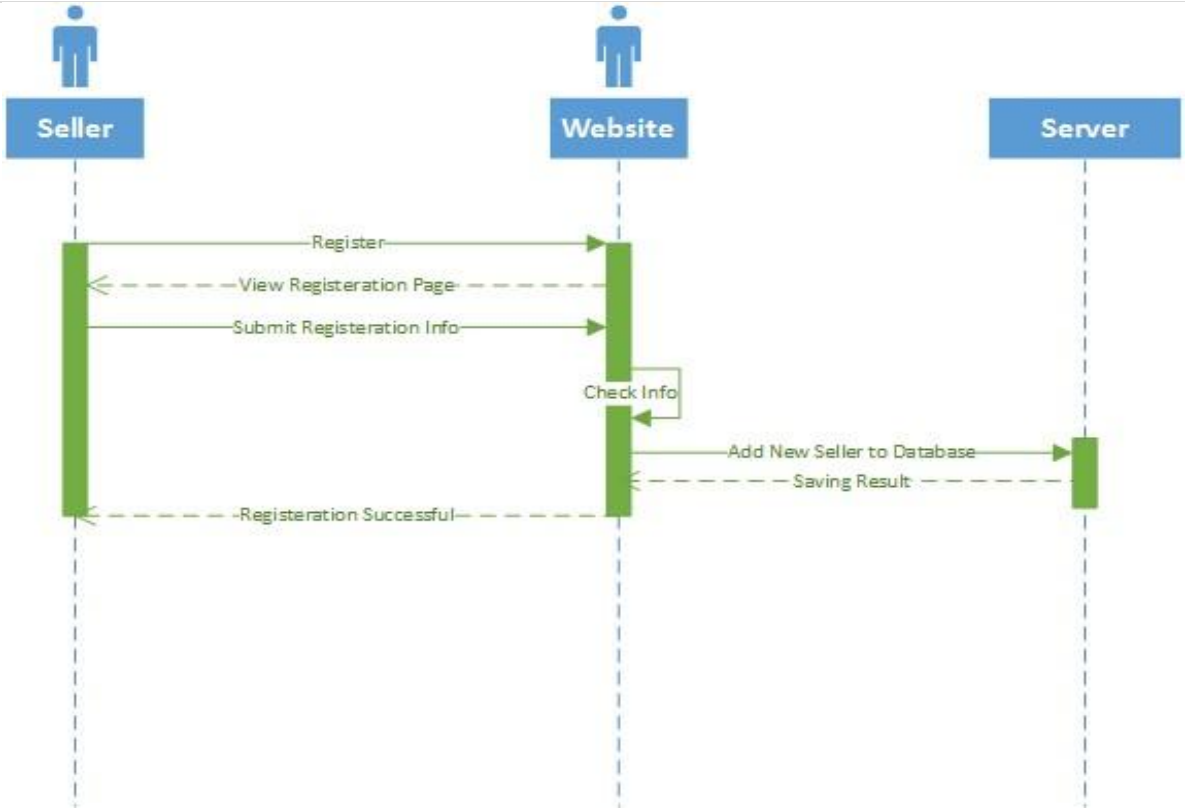


Figure 3-11: User Registration Sequence Diagram.

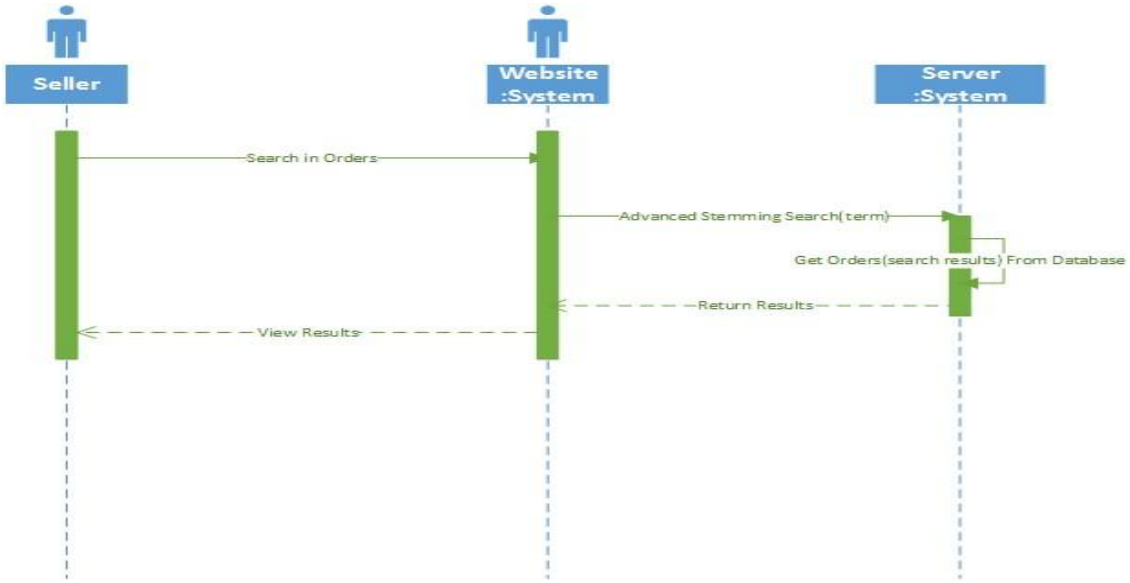


Figure 3-12: Search for Order Sequence Diagram.

3.4.4 Website Server Data Flow Diagram

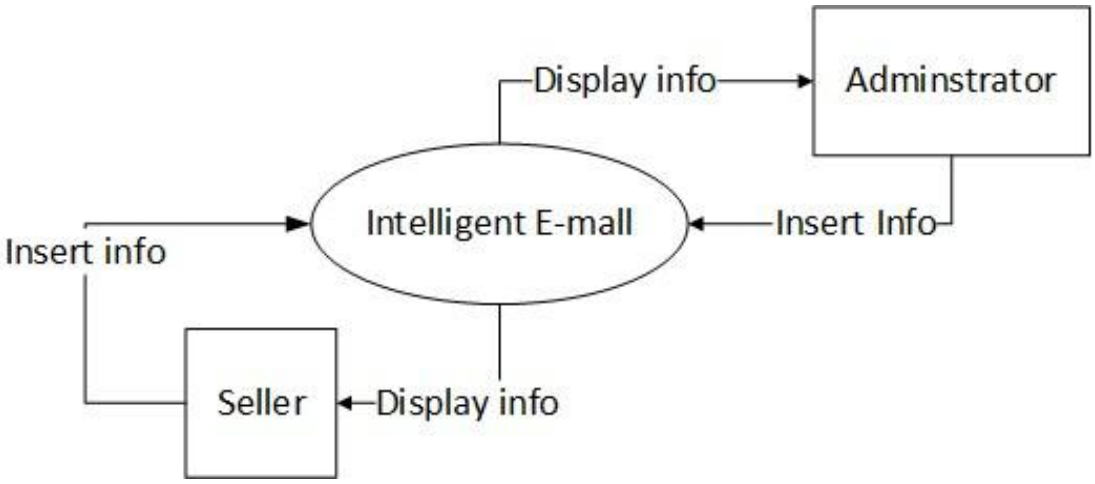


Figure 3-13: Website Data Flow Level Zero Diagram.

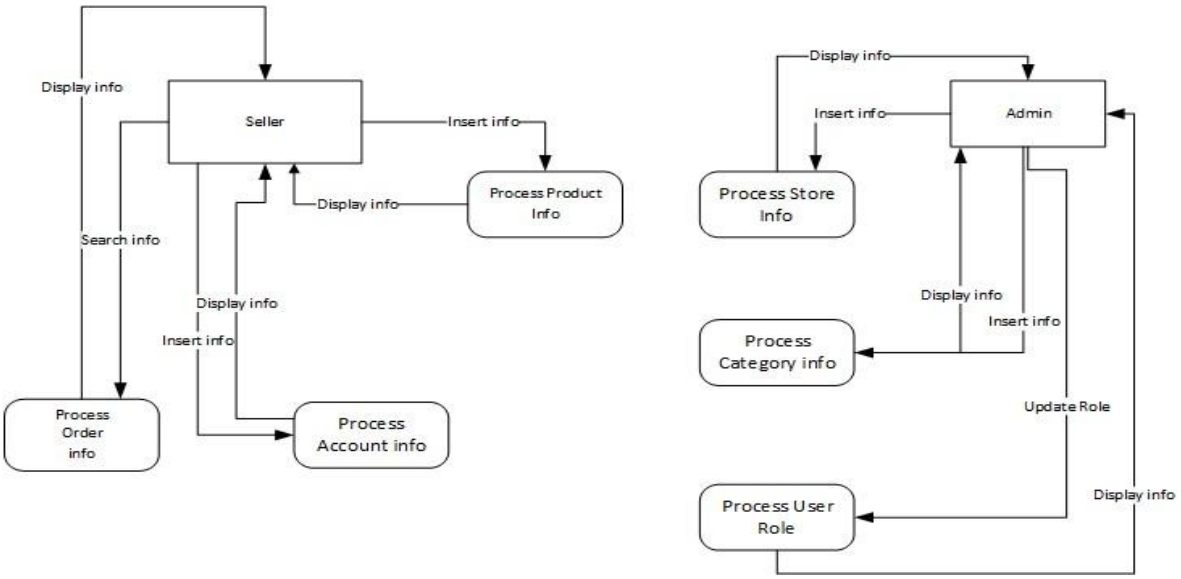


Figure 3-14: Website Data Flow Level One Diagram.

3.4.5 Activity Diagrams

In this section will discuss about the activity diagrams, which include some of android activity diagrams, such as, android login, android add product to cart and android payment. Furthermore, explained about some of website activity diagrams, which include the website login, website, add store and website search.

3.4.5.1 Some of Android Activity Diagrams

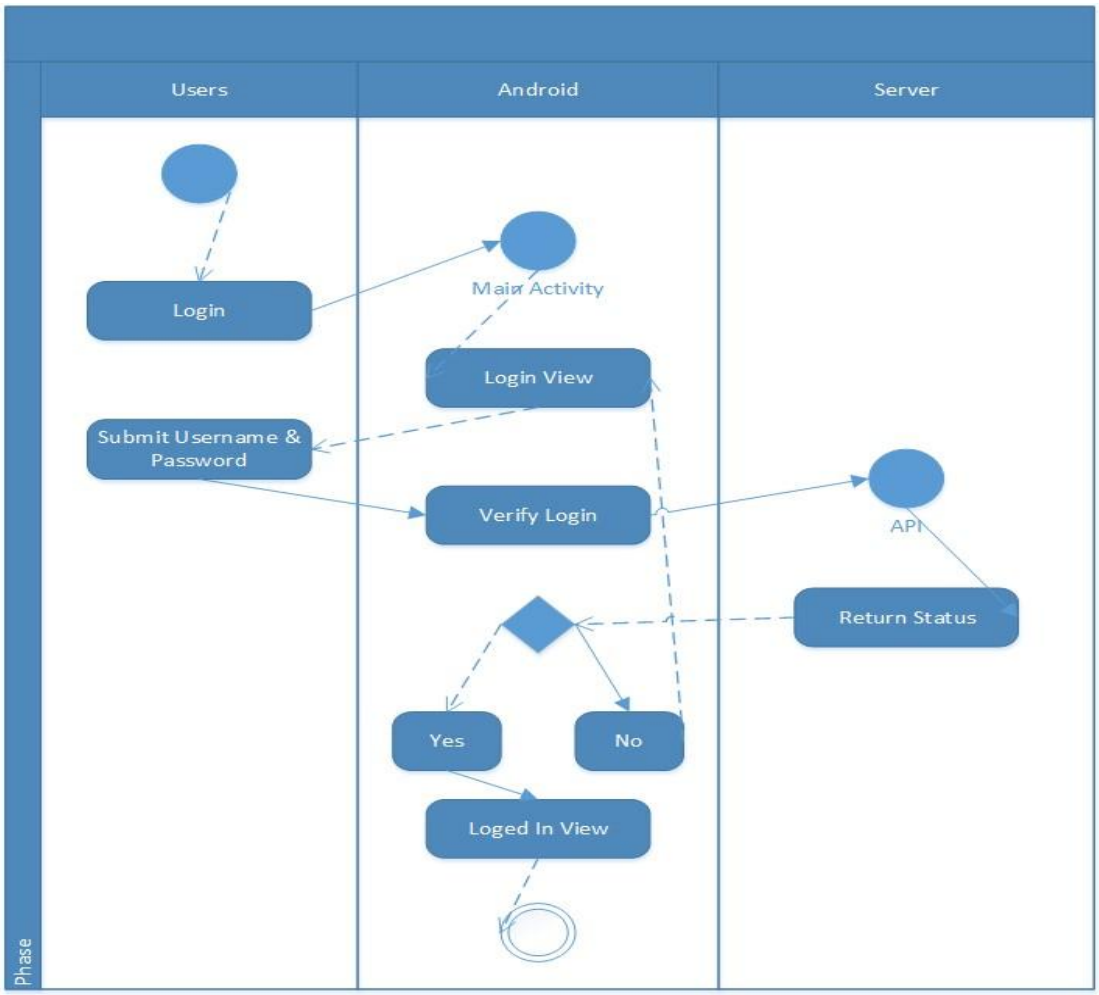


Figure 3-15: Android Login Activity Diagram.

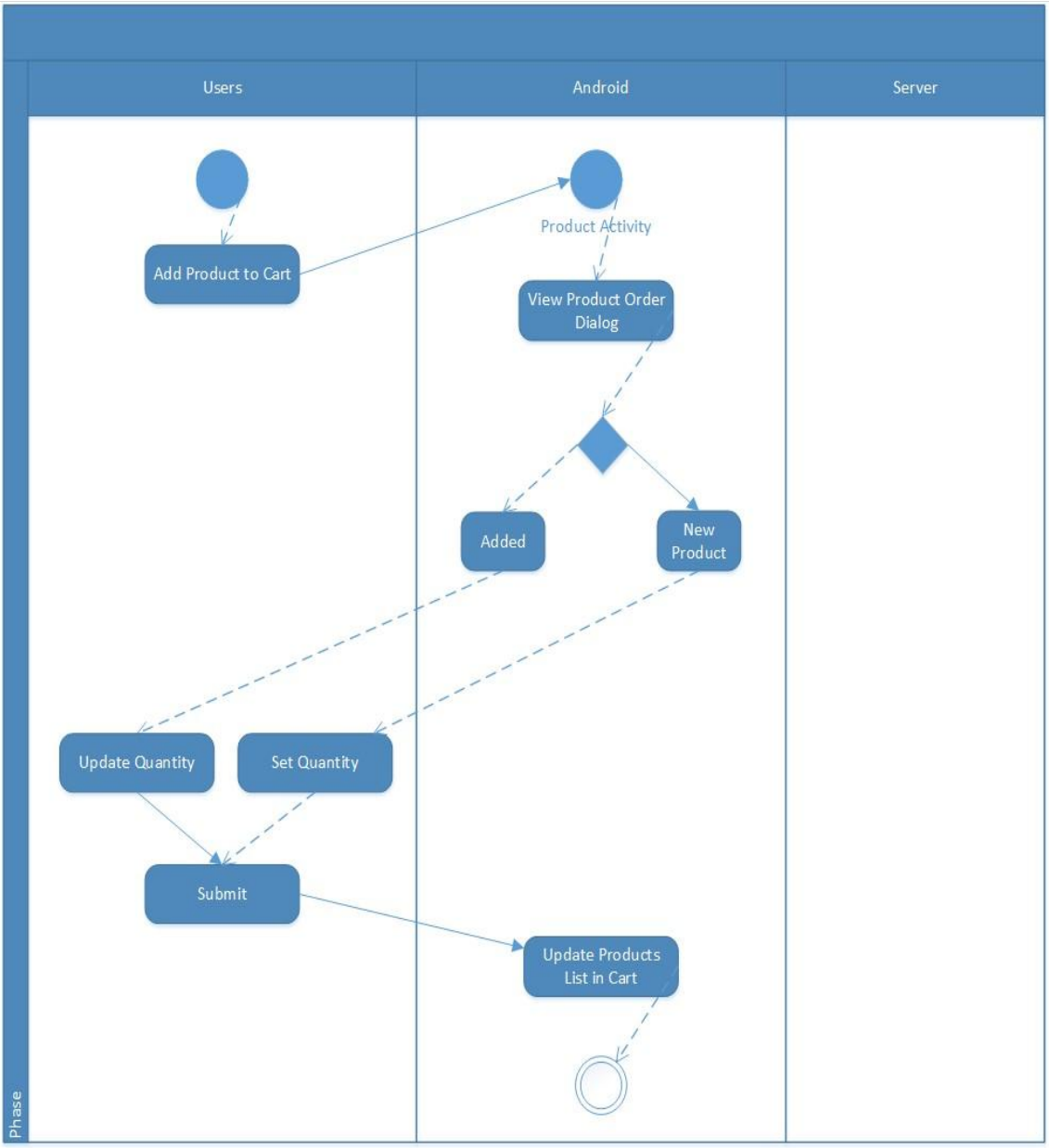


Figure 3-16: Android Add Product to Cart Activity Diagram.

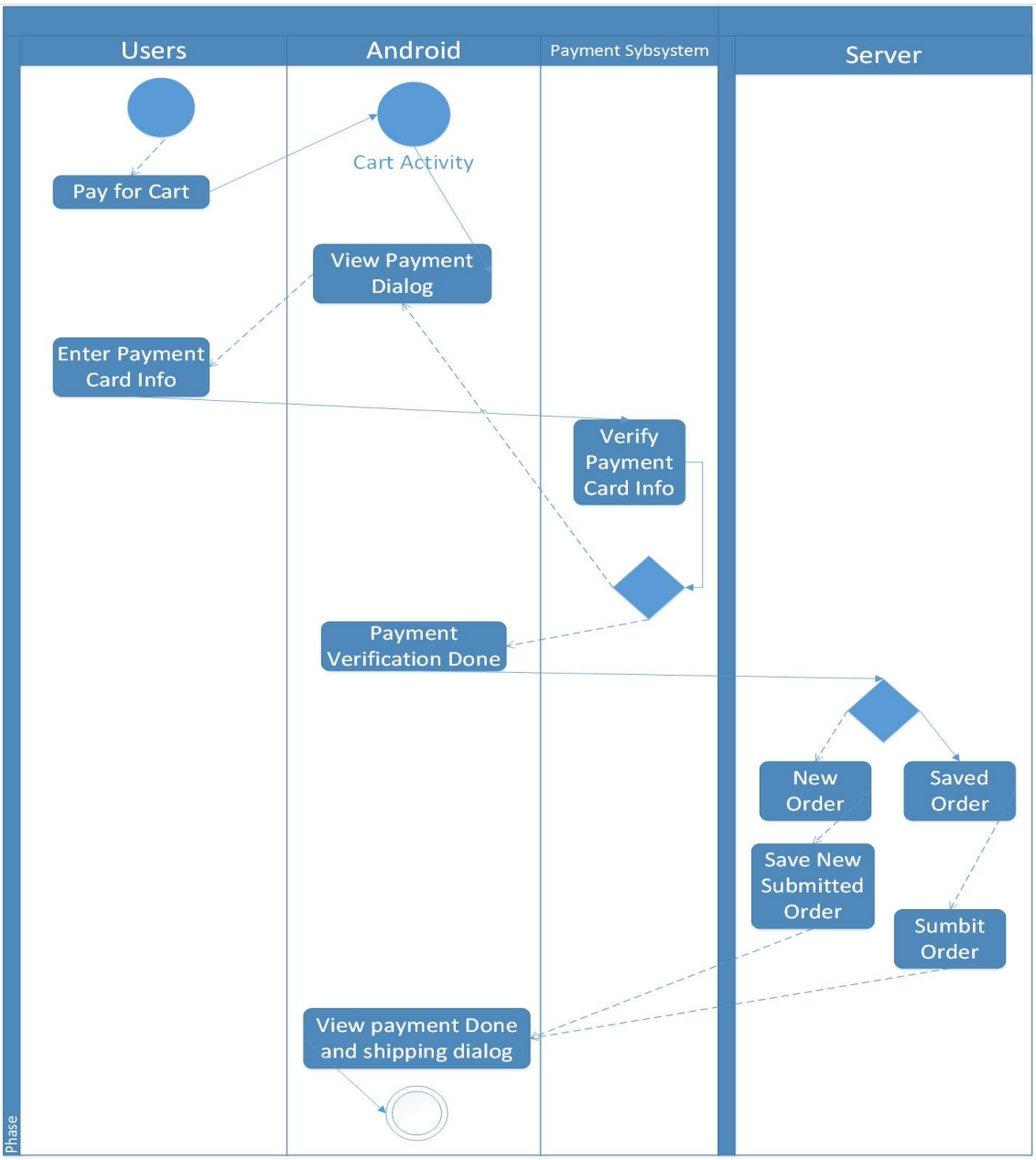


Figure 3-17: Android Payment Activity Diagram.

3.4.5.2 Some of Website Activity Diagrams

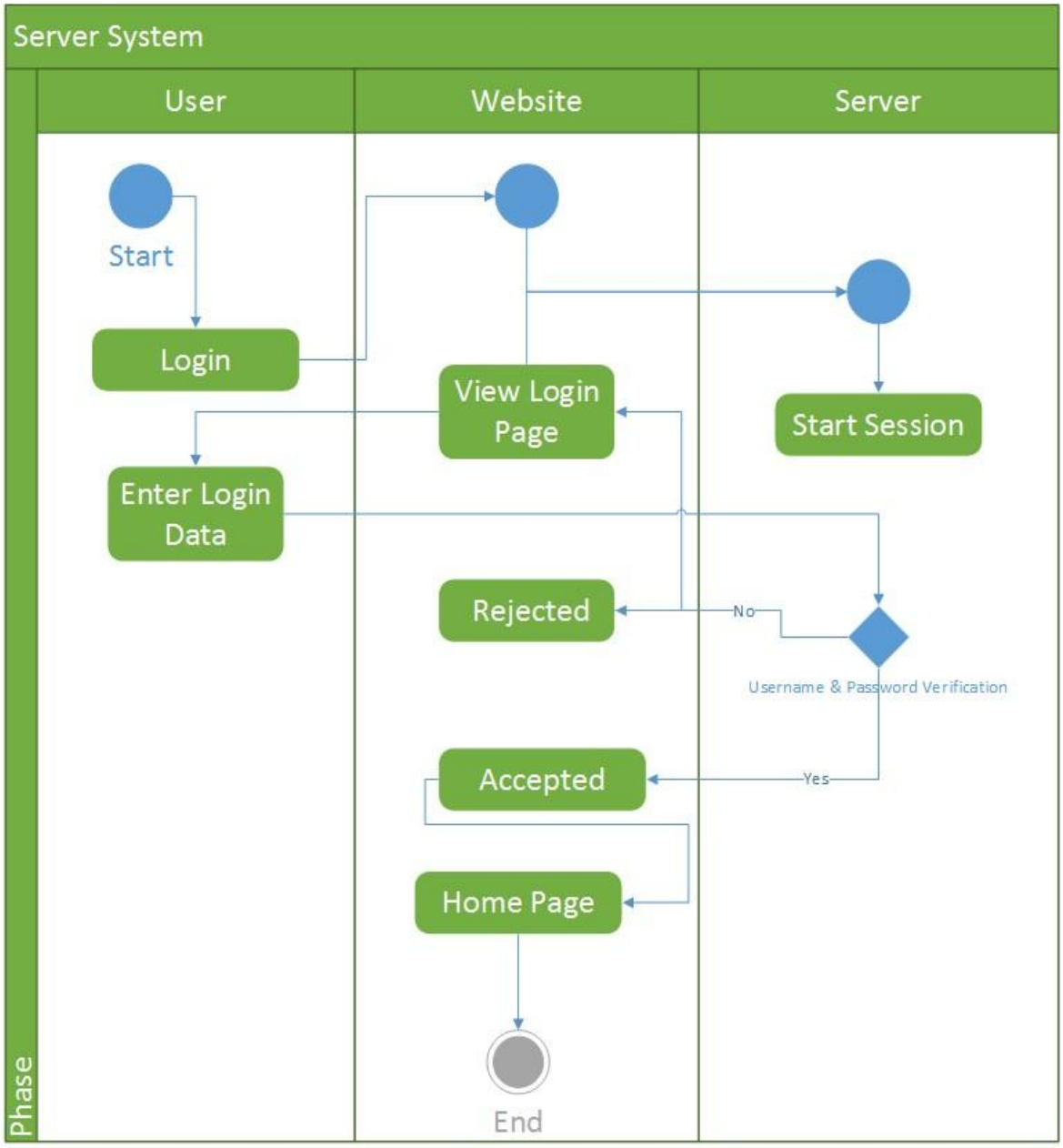


Figure 3-18: Website Login Activity Diagram.

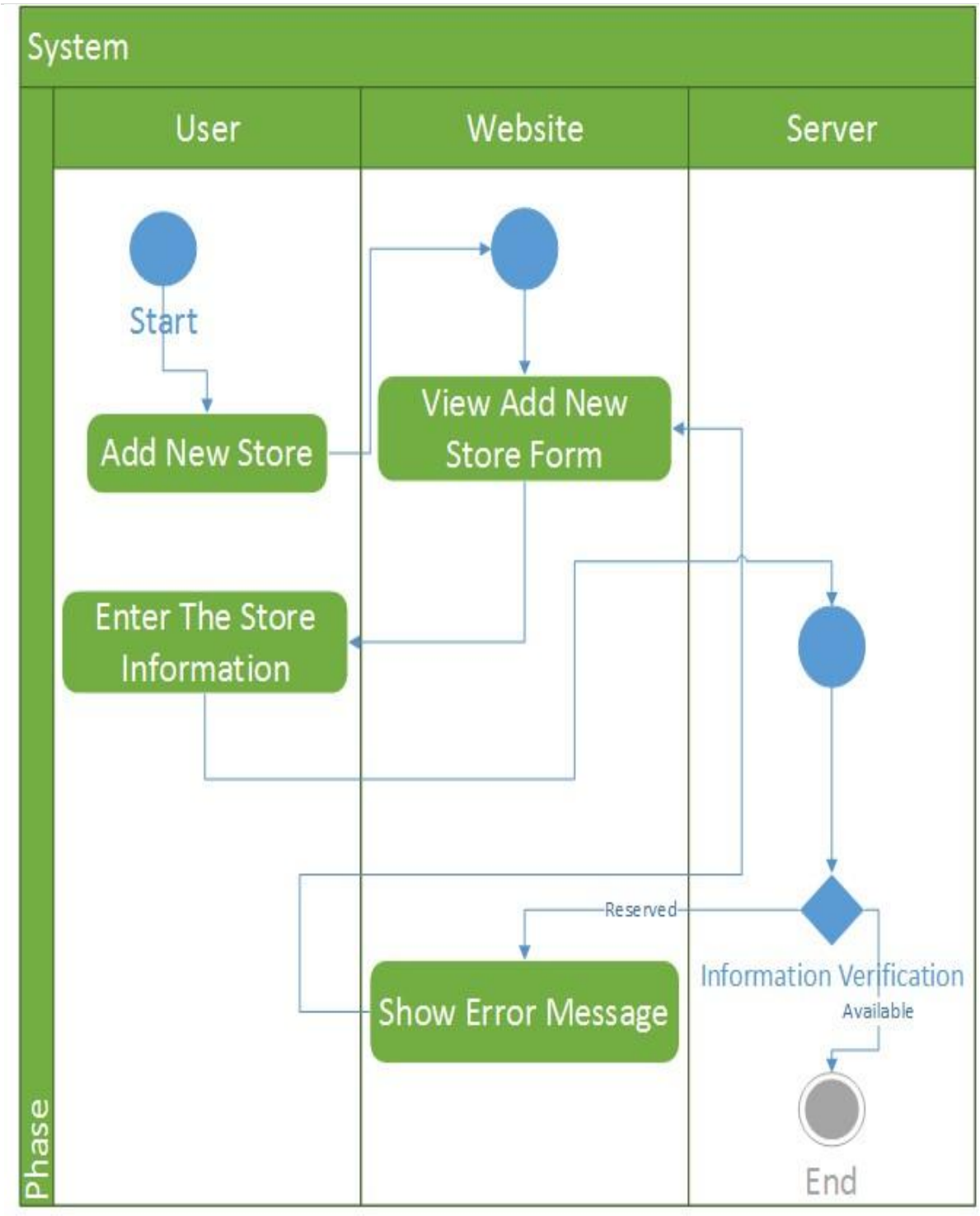


Figure 3-19: Website Add Store Activity Diagram.

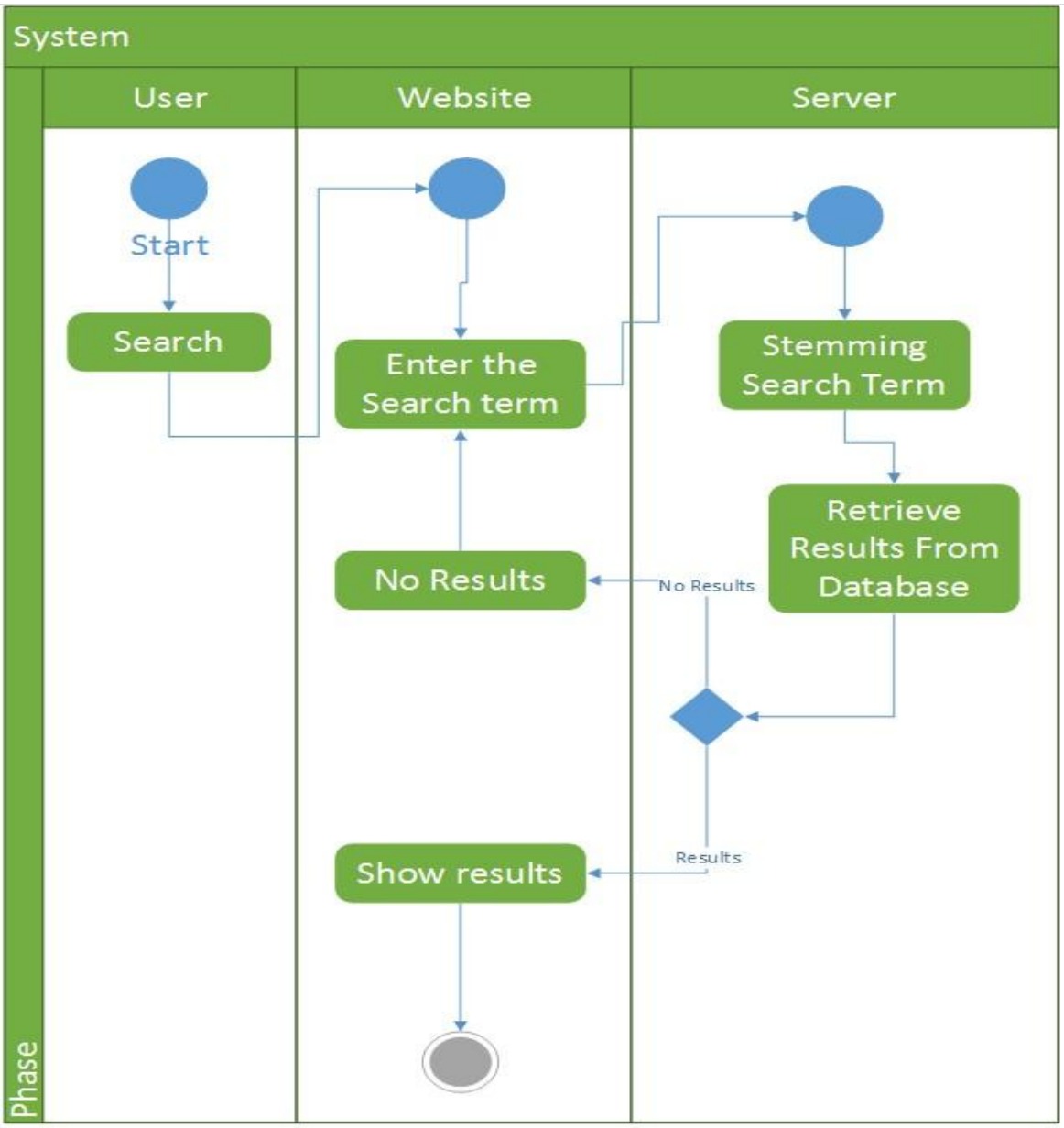


Figure 3-20: Website Search Activity Diagram.

3.4.6 Class Diagrams

This section will explain in brief about the Android Class Diagram, as shown below tin the following subsection.

3.4.6.1 Simple Android Class Diagram (Brief)

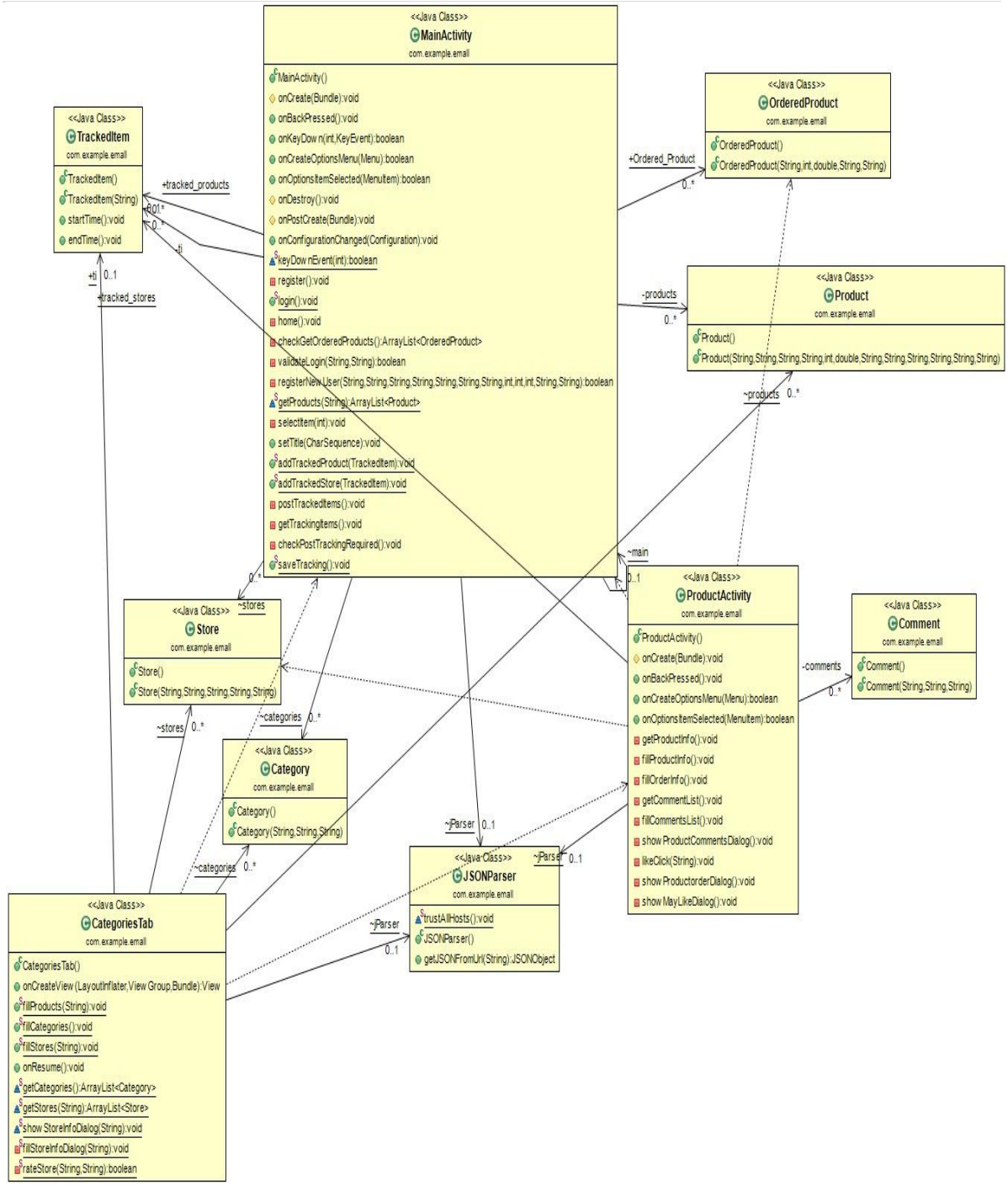


Figure 3-21: Simple Android Class Diagram (Brief).

3.4.7 ERD Diagram

In this section will show the fully details about the entity relationship diagram of the main System and the entity relationship diagram of the Fuzzy System.

3.4.7.1 Main System ERD Diagram

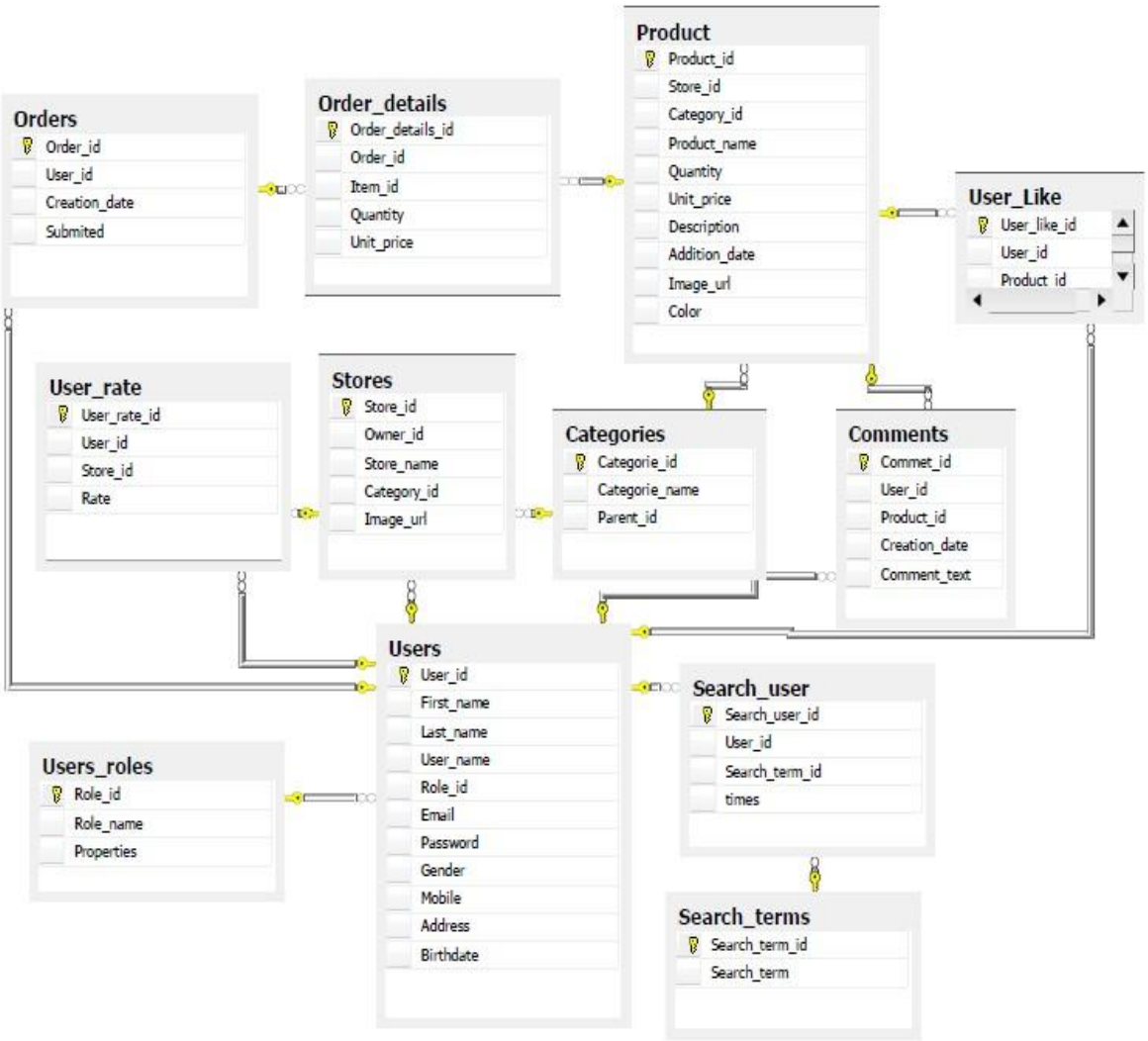


Figure 3-22: Main System ERD Diagram.

3.4.7.2 Fuzzy System ERD Diagram

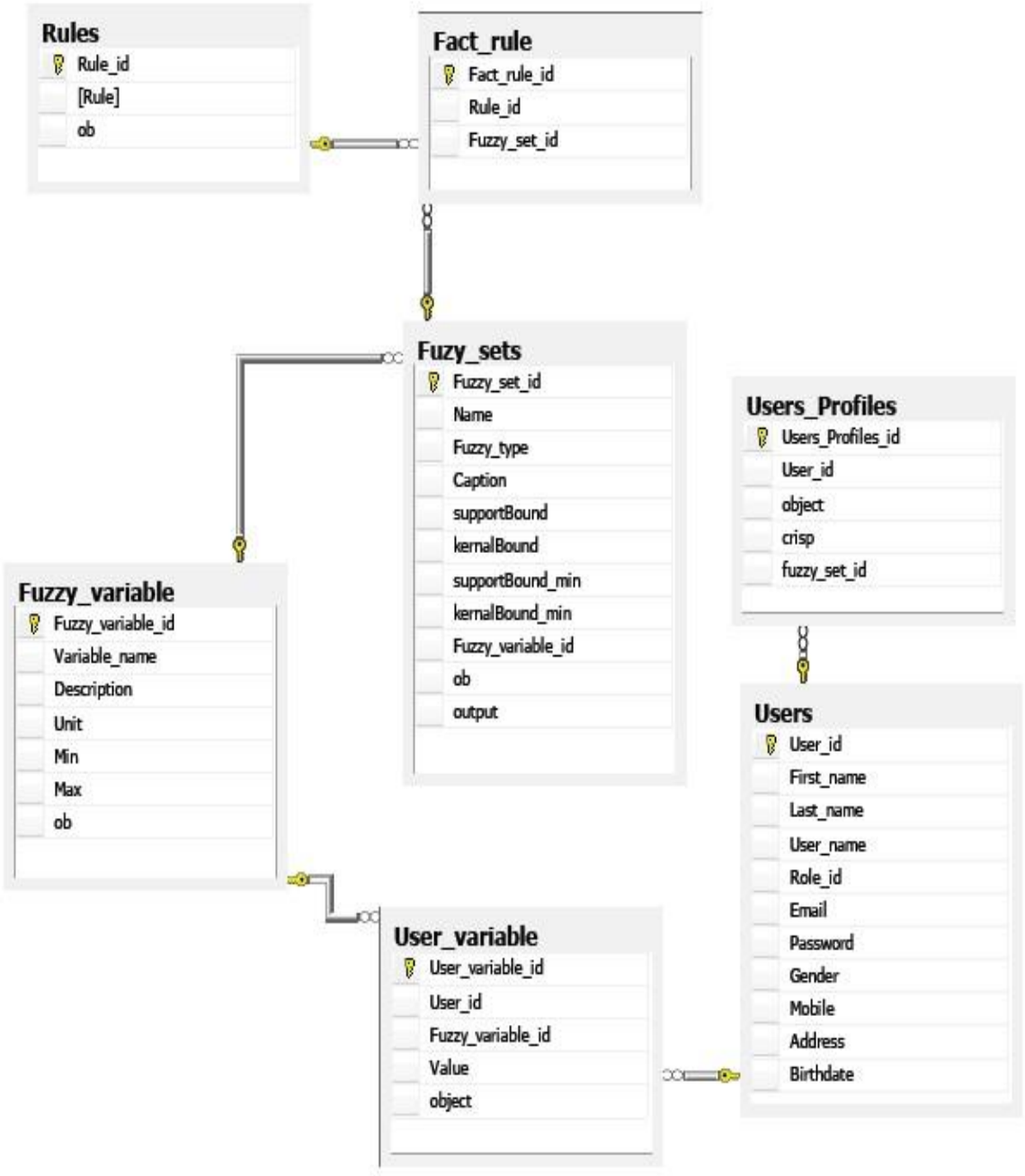


Figure 3-23: Fuzzy System ERD Diagram.

3.5 Implementation

This section contains some of the java android application classes and functions, and a brief definition of server API cases and fuzzy implementation.

3.5.1 Client Side Mobile Application (Emall.apk)

This is the main Android application. It is the application used by customers to login/logout from account, surf stores/products, like/comment on products, rate stores, and accumulate/save/edit/clean/delete from cart. In turn, the application track actions, behavior and interests of the user and sends it to the server to be processed. Furthermore, there are many of the core classes, and Core Functions that used in the implementation part, will be shows in Appendix B.12 and B.13.

3.5.2 Server Side

This is where the processing of all the system data. The server API which handling all the data retrieving request from the Android application, and the post pages which get the post data from the Android application. The fuzzy processing on user's data for profile building (retrieving fuzzy sets, variables, rules from the database). The data mining on customer profiles data and their orders to intelligently recommend products for Android customers. Fuzzy framework: It is collection of libraries for implementing fuzzy logic in C#, it has built in classes which make it easy to create fuzzy objects like fuzzy sets, fuzzy dimensions, fuzzy rules, etc.

3.5.2.1 Core Functions

public void session()

protected void Upload(object sender, EventArgs e)

protected bool profiler(int userid, string variable_name)

protected void search()

public info GetStoreinfo(int id)

public info GetProductinfo(int id)

3.5.2.2 Server API Cases

Each case fires the corresponding fuzzy rules for fuzzy processing.

Case1: login verification.

Case2: new user registration.

Case3: return a list of all stores.

Case4: return a list of all categories.

Case5: return a list of all products for a store.

Case6: return top selling products.

Case7: return all store info.

Case8: return search results for products/stores.

Case9: return all product info.

Case10: like/dislike a product.

Case11: rate a store.

Case12: comment on a product.

Case13: return top 10 keywords searches.

Case14: return all user info.

Case15: delete saved cart.

Case16: pay for cart (submit).

Case17: load saved cart.

Case18: application background color.

Case19: return recommendation.

Case20: return you may like products.

3.5.3 Website

This is the E-mall website which can be used only for sellers and the administrator. Sellers can manage their store and products, and view reports and recommendations on their store. Administrator can manage users roles, products' comments, categories and view overall sales reports.

3.6 Summary of the Chapter

This chapter contends the deep details about the overall system with the phases and plans, system design with the user case diagrams for the website server side, and the android side, narrative diagrams for the android application and website server, sequence diagrams for the android and the website server. Furthermore, the website server data flow diagrams are explained. And then the activity diagrams for the android and the website server. Finally, this chapter explained the class diagrams and the ERD diagrams.

Chapter 4

Implementations and Results

Introduction

In this chapter, will discuss in details about the proposed framework, and shows the overall information about the system and the proposed fuzzy framework.

4.1 The Overall Proposed System

The proposed fuzzy framework is using an intelligent fuzzy rule based system to generate, build and update users' profiles. E-mall fuzzy rule based system depends on multiple inputs which received by mobile tracking or retrieved from available data in database to generate a profile for each user as shown in figure 4.1.

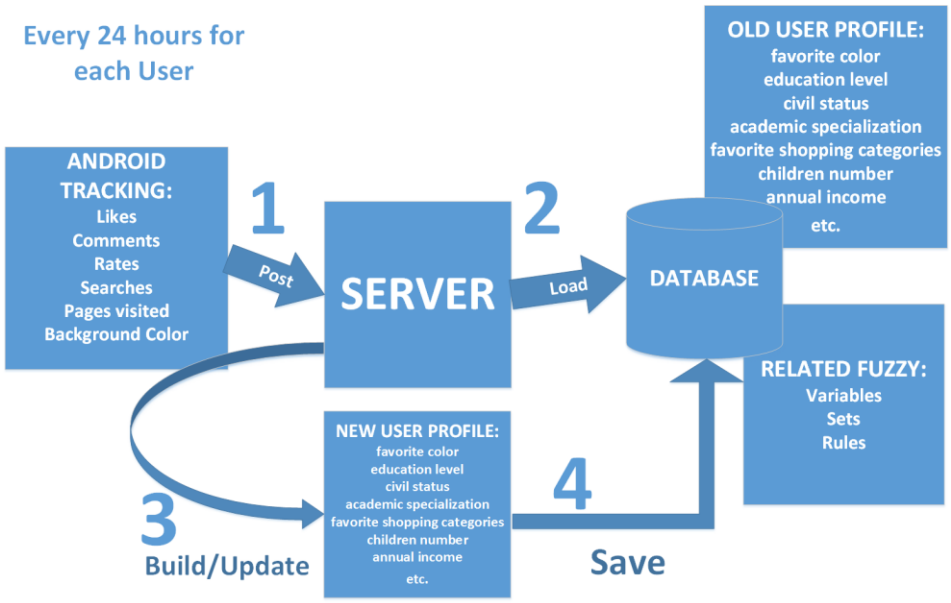


Figure 4-1: A general scenario for the overall system.

4.2 The Proposed Fuzzy Framework

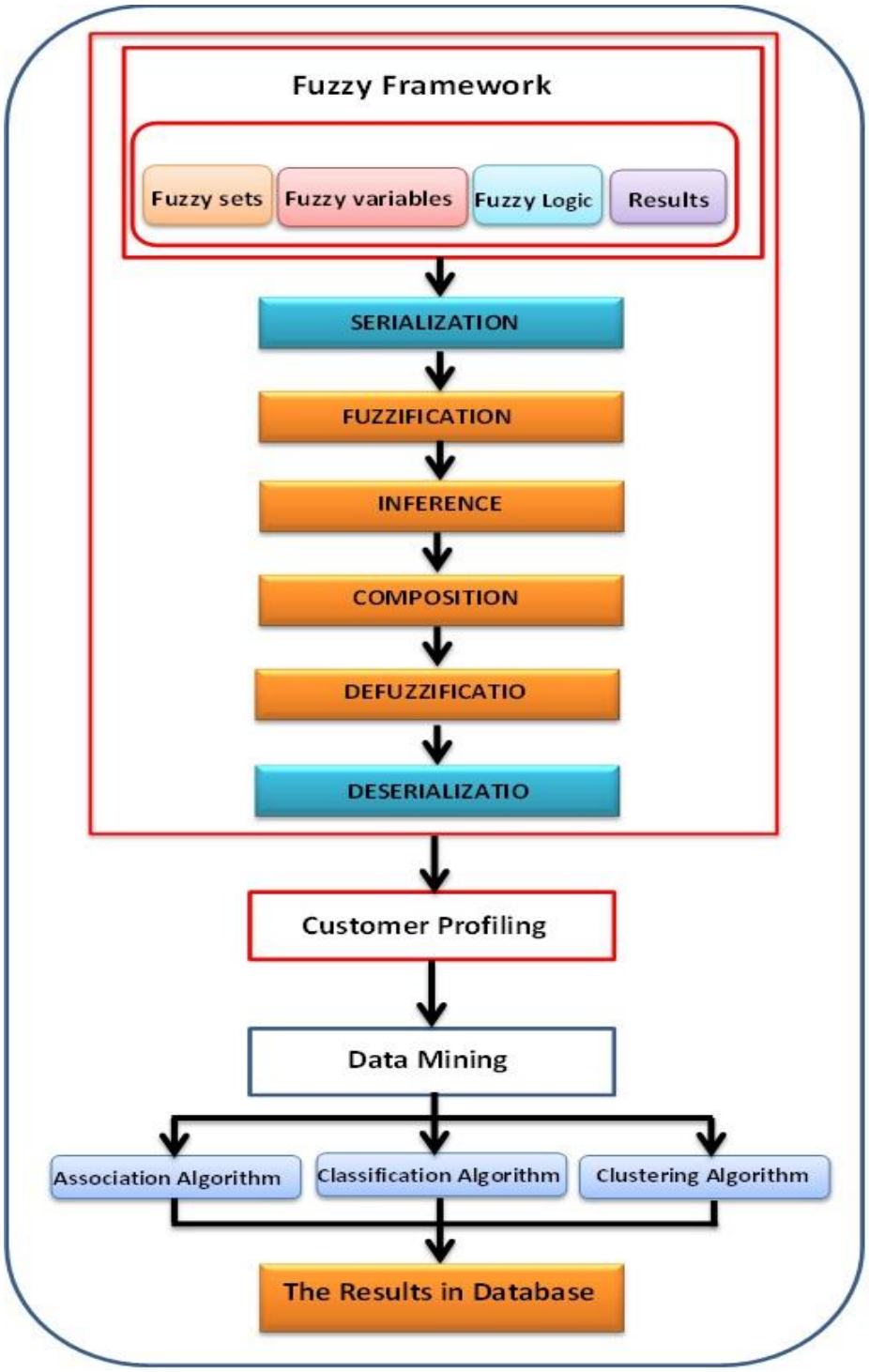


Figure 4-2: The Proposed System.

Fuzzy framework: It is collection of libraries for implementing fuzzy logic in C#, it has built in classes which make it easy to create fuzzy objects like fuzzy sets, fuzzy dimensions, fuzzy rules, etc. The C# classes that used in the fuzzy framework shows in Figure B.1 Appendix B.

4.2.1 Fuzzy Dimensions (variables)

The type of the member, dimension in a fuzzy relation. It is obvious that for continuous sets, T will be of type Real, whereas for discrete sets, T can be any object this is primarily to provide a conversion of the member to its internal implementation as System.Decimal. o More precisely, distinct Dimension is required for each dimension of a fuzzy relation, even if the type would be common. Fuzzy Relation example: Choose_color_red x like_color. Yet there are two dimensions with different universes. The table of the Fuzzy Variable shows in Figure B.2 Appendix B.

-To define new dimension for Choose_color_red, for example: Public class Choose_color_red: System.Decimal, Fuzzy Framework Dimension.

4.2.2 Fuzzy Sets

Represents general fuzzy set, Such a set will be typically composed of: o Enumeration of values, each with a specific membership ranging from 0 to 1.- Continuus interval out of R, with the membership described by a function Mx = fS(x). Examples are triangle fuzzy number or trapezoid fuzzy number. o The set can have assigned a label (string) so that it's easy-toidentify by humans. Examples are labels "low", "fair" or "high" for a set representing a range of temperatures. The table of the Fuzzy Set shows in Figure B.3 Appendix B.

4.2.3 Fuzzy Rule

The fuzzy rule is the relations between fuzzy sets. The table of the Fuzzy Rule shows in Figure B.7 Appendix B.

- For example: fr= fs1 AND !fs2 .This rule firing when the fuzzy set fs1 is true and the fuzzy set fs2 is not true.

The main problem was fuzzy logic in C#. After a lot of search the solution was the usage of a special purpose framework (fuzzy framework).

If x is medium and y is high THEN z = medium

An example of applying this rule on E-mall fuzzy rule based system:

If Favorite_IT_books is high and Education_level is high THEN IT_academic_specialization = high

Where x and y are input variables (names for known data values), z is an output variable (a name for a data value to be computed), low is a membership function (fuzzy subset) defined on x, high is a membership function defined on y, and medium is a membership function defined on z. The antecedent (the rule's premise) describes to what degree the rule applies, while the conclusion (the rule's consequent) assigns a membership function to each of one or more output variables. Most tools for working with fuzzy expert systems allow more than one conclusion per rule. The set of rules in a fuzzy expert system is known as the rule based or knowledge based.

Fuzzy Logic

The fuzzy logic provides an inference morphology that enables approximate human reasoning capabilities to be applied to knowledge-based systems. The theory of fuzzy logic provides a mathematical strength to capture the uncertainties associated with human cognitive processes, such as thinking and reasoning.

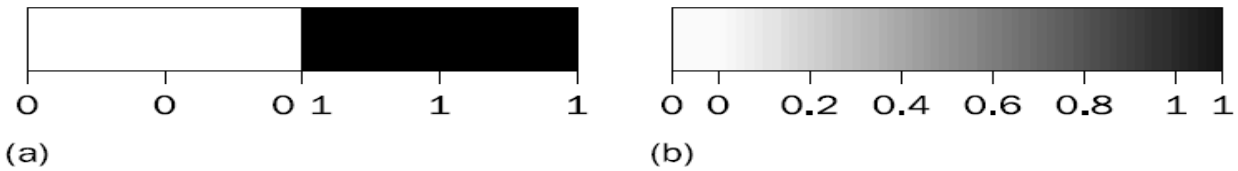


Figure 4-3: Range of Logical Values in Boolean and Fuzzy Logic: (a) Boolean Logic; (b) Multivalued Logic.

Unlike two-valued Boolean logic, fuzzy logic is multi-valued. It deals with degrees of membership and degrees of truth. Fuzzy logic uses the continuum of logical values between 0 (completely false) and 1 (completely true). Instead of just black and white, it employs the spectrum of colors, accepting that things can be partly true and partly false at the same time. As can be seen in Figure 3.4, fuzzy logic adds a range of logical values to Boolean logic. Classical binary logic now can be considered as a special case of multi-valued fuzzy logic.

Fuzzy Membership Function (FMF): a function describing the degree of membership (DOM) of an entity to a class with inexactly defined boundaries (fuzzy set).

The E-mall Fuzzy Variables and Sets

Fuzzy set: The fuzzy set can be simply defined as a set with fuzzy boundaries.

Let X be the universe of discourse and its elements be denoted as x. In classical set theory, crisp set A of X is defined as function (X) called the characteristic function of A

(X): $X \rightarrow 0,1$ (3-1)

Where

$$\mathbf{fA(X)} = \begin{cases} \mathbf{1, if\ x\ \in A} \\ \mathbf{0, if\ x\ \notin A} \end{cases}$$

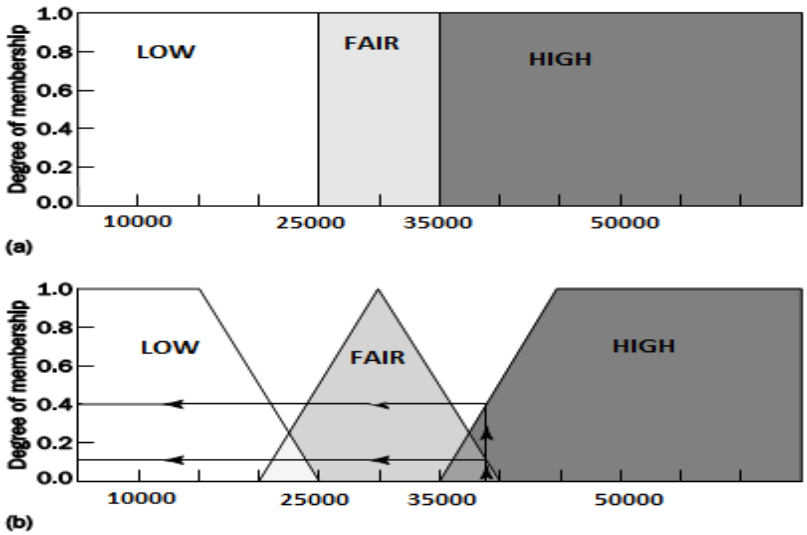


Figure 4-4: Crisp (a) and Fuzzy (b) Sets of Annual Income Fuzzy Variable.

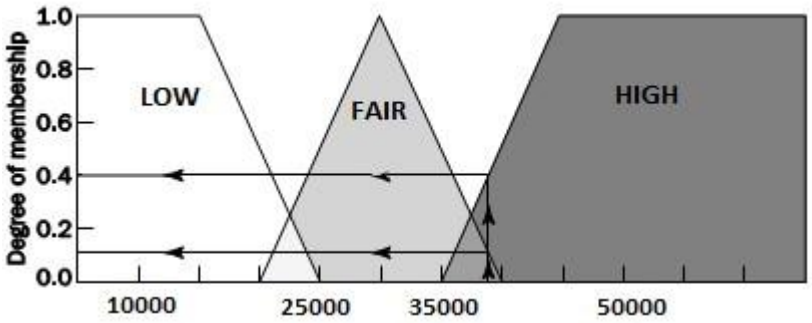


Figure 4-5: Annual Income Fuzzy Variable.

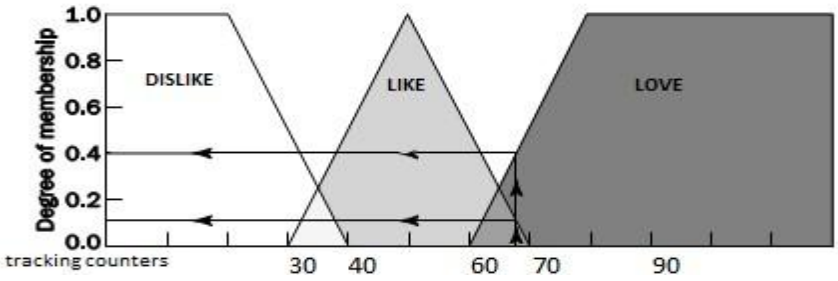


Figure 4-6: Red Color Love Fuzzy Variable.

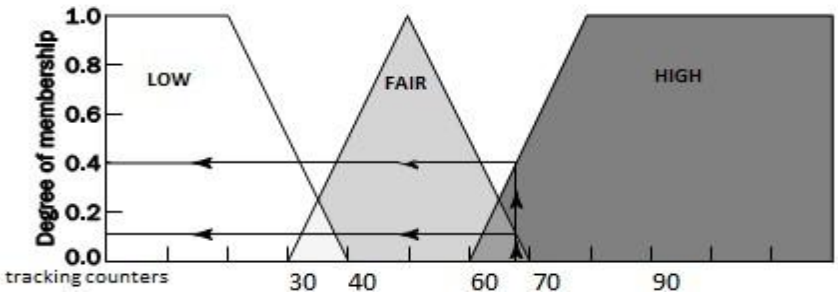


Figure 4-7: Education Level Fuzzy Variable.

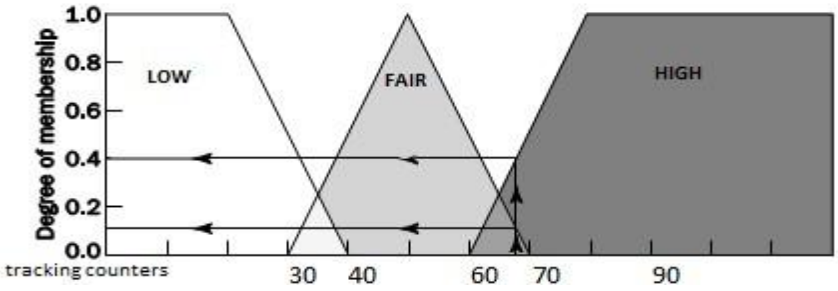


Figure 4-8: Action Movies Category Follow up Fuzzy Variable.

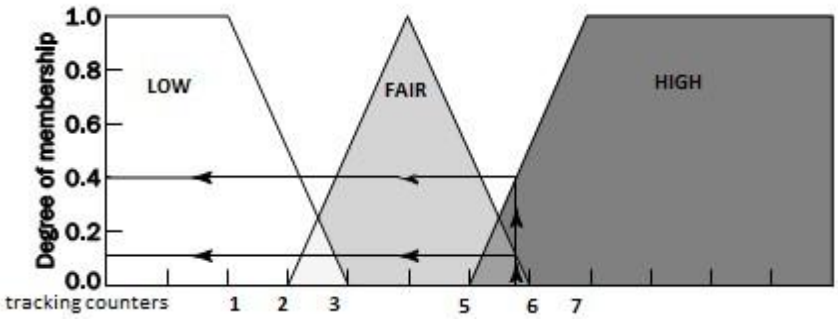


Figure 4-9: Children Number Fuzzy Variable.

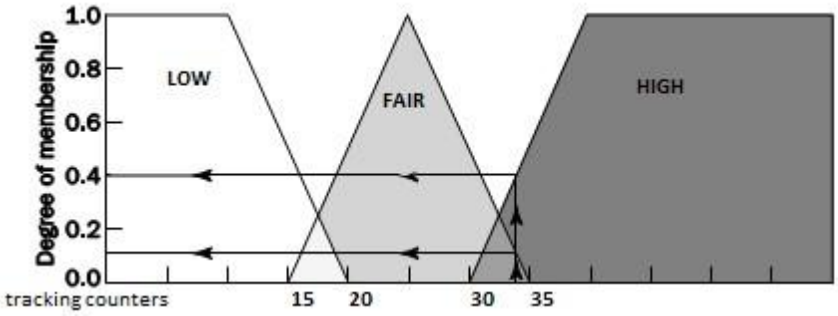


Figure 4-10: Married Marital Status Fuzzy Variable.

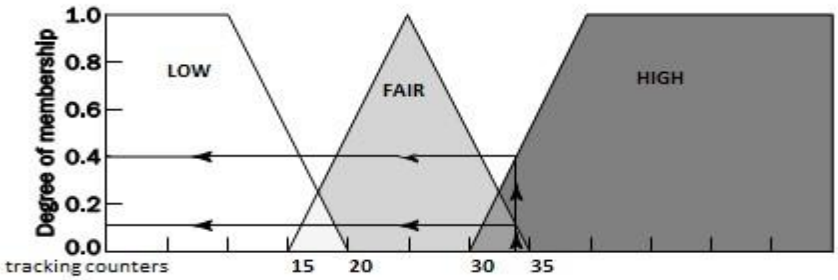


Figure 4-11: IT Academic Specialization Fuzzy Variable.

Fuzzy Rules: a fuzzy rule can be defined as a conditional statement in the form:

IF x is A

THEN y is B

Where x and y are linguistic variables; and A, B are linguistic values determined by fuzzy sets on the universe of discourses X and Y, respectively.

4.4 E-mall Fuzzy Rule Based System Rules

E-mall is combine fuzzy (ex. Children Number) and non-fuzzy variables (ex. Age) in its rules. The general inference process proceeds in four steps:

4.4.1 Fuzzification

Under fuzzification, the membership functions defined on the input variables are applied to their actual values, to determine the degree of truth for each rule premise.

4.4.2 Inference

Under inference, the truth value for the premise of each rule is computed, and applied to the conclusion part of each rule. This results in one fuzzy subset to be assigned to each output variable for each rule. Usually only MIN or PRODUCT are used as inference rules. In MIN inferencing, the output membership function is clipped off at a height corresponding to the rule premise's computed degree of truth (fuzzy logic AND). In PRODUCT inferencing, the output membership function is scaled by the rule premise's computed degree of truth.

4.4.3 Composition

Under composition, all of the fuzzy subsets assigned to each output variable are combined together to form a single fuzzy subset for each output variable. Again, usually MAX or SUM are used. In MAX composition, the combined output fuzzy subset is constructed by taking the point wise maximum over all of the fuzzy subsets assigned to variable by the inference rule (fuzzy logic OR). In SUM composition, the combined output fuzzy subset is constructed by taking the point wise sum over all of the fuzzy subsets assigned to the output variable by the inference rule.

4.4.4 Defuzzification

Finally is the (optional) Defuzzification, which is used when it is useful to convert the fuzzy output set to a crisp number. There are more defuzzification methods than you can shake a stick at (at least 30). Two of the more common techniques are the Centroid and Maximum methods. In the Centroid method, the crisp value of the output variable is computed by finding the variable value of the center of gravity of the membership function for the fuzzy value. In the Maximum method, one of the variable values at which the fuzzy subset has its maximum truth value is chosen as the crisp value for the output variable.

4.5 Fuzzy Logic and Database

The fuzzy logic and database as in e-mall ERD diagram (figure 3.2) e-mall fuzzy rule based system stores and retrieves all its variables, sets, and rules in a special implemented database so the process of adding, editing deleting any sets, variables or rules will be as easy as retrieving it from their tables. Also, it will facilitate the applying of intelligent machine learning algorithms on the system's fuzzy rules will be available, more efficient and convenience in programming.

Another problem was finding a suitable way to store the defined fuzzy objects (variables, sets, dimensions and rules) in the database and retrieve them as objects. The solution was by making all of the fuzzy objects serializable to convert them to binary (serialization) so it's possible to store them in the database as varbinary (max) type. Furthermore, using deserialization to convert them from binary to the original fuzzy object with all of its values and features when retrieving them back from the database in the code.

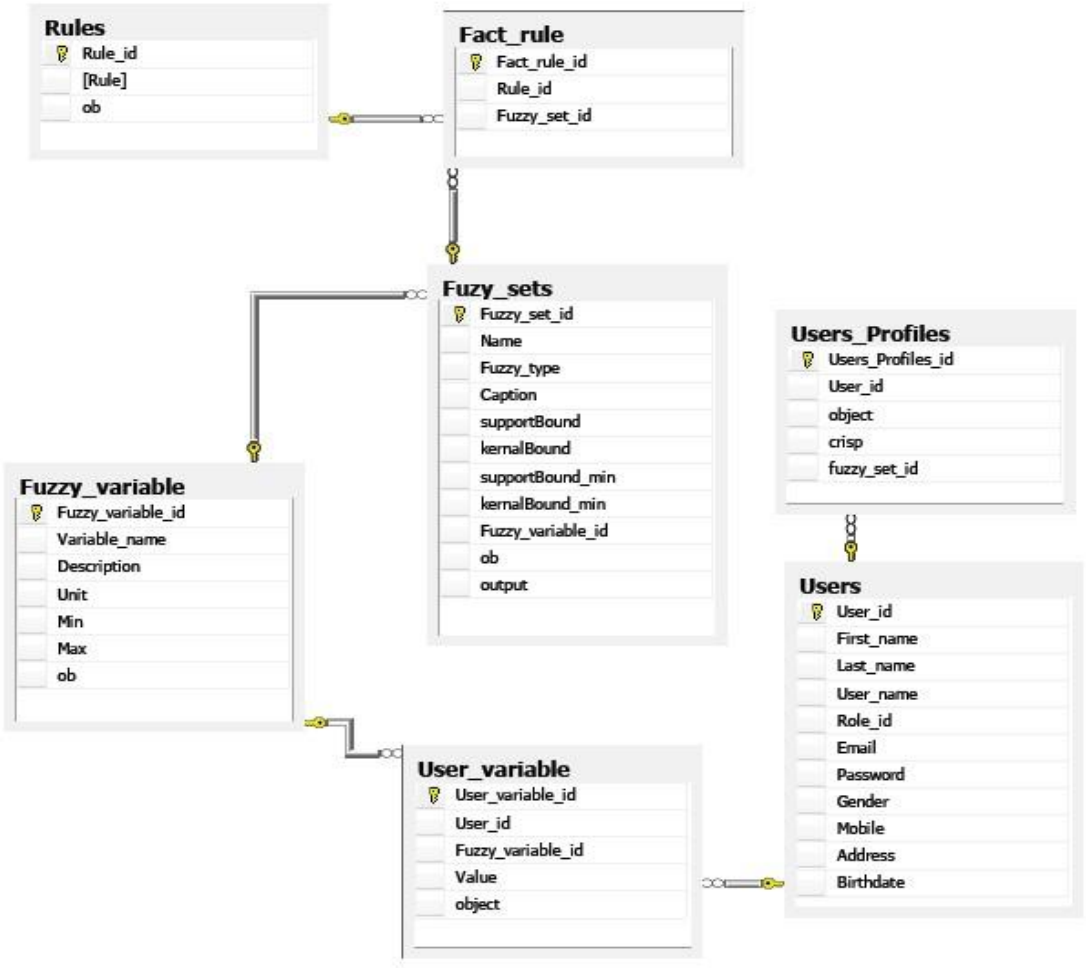


Figure 4-12: Fuzzy System ERD Diagram.

4.6 Sample Fuzzy Rules

IF Gender is female AND Age is young AND Pink_Color_Love is high THEN Movies_romance_category_Follow_up is high

IF Education_level is high AND Favorite_IT_books is high THEN IT_academic_specialization is high

IF like_Books_Computer_and_Technology is high AND like_Computers is high THEN IT_academic_specialization is high

IF like_Red is high AND like_Books_Romance THEN like_Gifts_Women is high

IF Married_Martial_status is high AND age is young THEN Chlidren_number is low

IF like_Cars_and_Accessories is high AND like_Clothing_and_Accessories_Men is high THEN annul_income is high

IF choose_Video Gaming is a lot THEN like_Video Gaming is high

IF choose_Electronics is alittle THEN like_Electronics_fair

IF choose_Cars_and_Accessories is medim THEN like_Cars_and_Accessories is low

IF choose_Books is alot THEN like_Books is high

IF choose_Clothing and Accessoriesis medium THEN like_Clothing and Accessories is fair

IF choose_Jewerly_and_Watches is alittle THEN like_Jewerly_and_Watches_low

IF choose_Media is a lot THEN like_Media is high

IF choose_Mobiles is medium THEN like_Mobiles is fair

IF choose_Computers is alittle THEN like_Computers is low

IF choose_Gifts is a lot THEN like_Gifts is high

IF choose_Media_Comedy is medium THEN like_Media_Comedy is fair

IF choose_Media_Action is alittle THEN like_Media_Action is low

IF choose_Media_Horror is a lot THEN like_Media_Horror is high

IF choose_Red is a lot THEN like_Red is high

IF choose_Video Gaming_Strategy is alot THEN like_Video Gaming_Strategy is high

IF choose_Video Gaming_Action is a lot THEN like_Video Gaming_Action_high

IF choose_Media_Martial Arts is a lot THEN like_Media_Martial Arts is high

4.7 Customer Profiling

The customer profiling using data or information about users to better understand what they needs and expectations at anytime and anywhere, This profiling used to help in the design and delivery of services for the customers. Effective use of customer profiling can help you to Produce an effective and efficient tailored services Target resources according to priorities, Produce responsive services that encourage and reflect customer engagement and used the customer profiling to improve service and improve the services to get what they needs as shown in Figure 4-13.

The proposed system used the customer profiling depend of the customer behavioral, which means the profile and target users by interest, based on their previous tracked activity. When you have affinity group that fits into one of the larger scale cookie-cutter segments expect to see innovation in health-customized solution. The table of the customer profiling shows in Figure B.4, Appendix B.

Figure 4-13: Customer Profile Dimensions.

Examples of User Profile Contents.

Interests

Knowledge, background and Skills

Goals

Behavior

Interaction Preferences

Individual Characteristics

Contextual Information

Group Profiles

4.7.1 E-mall Fuzzy Profiling Approach

Demographic segmentation: Demographic segmentation involves analyzing the observable and measurable features of the population. Such features or variables include age, gender, and family size, stage of the family cycle, income, occupation, education, religion, race and nationality.

Annual Income: Income is arguably the most important factor determining the likelihood of owning a computer or having access to the Internet. The distribution of wealth is of great importance to marketers, as it determines which groups have the greatest buying power and market potential. Occupation and education, which are acquired by means of income, directly influence preference for products, media and activities. Thus income is generally more effective as a segmentation variable when used in conjunction with other demographic variables.

Family Life-cycle Stages, Age, and Children Number:

For example:

Young and single

Young and married

Young, married with child under 6 years

Young, married with youngest child 6 or over

Older, married with children

Older, married with no children under 18

Gender: Segmentation by gender of consumers is most common in marketing of fashion goods, cosmetics and jewelry.

Education Level and Academic Specialization: Another important factor determining Laptop ownership and books purchase is education. There is a strong correlation between the levels of education and the likelihood of having academic books.

Psychographic Segmentation: Psychographics or lifestyle segmentation includes obtaining information regarding customer's attitudes, values, activities and interests and media patterns.

Social class: The social class of a person is based on the person's occupation or the head of the household's occupation. The head of the household is that member of the household who assumes the financial responsibility for the welfare of the family and for the maintenance of the household. Social class can be used in conjunction with income and age to provide a strong base for targeting products like cars, entertainment or leisure activities.

Usage Rate and Periods: By understanding the most categories the user visit and spend time surfing it. The system can have a background about user's favorites.

Color: The favorites colors for a user.

4.8 Data Mining

Several definitions have been proposed for data mining. One definition sees data mining as the process of applying data analysis and discovery algorithms that, under acceptable computational efficiency limitations, produce enumeration of patterns (or models) over the data. Another defines data mining as "The induction of understandable models and patterns from databases". Or, initially have a large (possibly infinite) collection of possible models (patterns) and (finite) data. Data Mining should result in those models that describe the data best, the models that fit (part of the data).

4.8.1 Data Mining Classification Task

The classification consists of examining the features of a newly presented object and assigning to it a predefined class. The classification task is characterized by the well-defined classes, and a training set consisting of pre classified examples. The task is to build a model that can be applied to unclassified data in order to classify it. Examples of classification tasks include:

Classification of credit applicants as low, medium or high risk

Classification of mushrooms as edible or poisonous

Determination of which home telephone lines are used for internet access

4.8.2 Data Mining Clustering Task

Clustering or grouping is creating subgroups that share common features. Clusters do not have predefined classes; it is rather similarity that gathers them. Clustering is a process conducted as a preliminary for a data mining form. Clustering, for instance, can be the first step in market segmentation effort, instead of trying to come up with a one-size-fits-all rule for determining what kind of promotion works best for each cluster. The table of the Result- Clustering, shows in Figure B.6, Appendix B.

4.8.3 Data Mining Association Rules Task

Association rule refers to a correlation between a group of objects in a certain database, i.e. the objects either occur together or one implies the other. For example, if 30% of a group of farmers grow wheat also grow pulses; 2% of all farmers grow both wheat and pulses. The 30% is considered confidence and the 2% is the support. All association rules that satisfy user-specified minimum support and minimum confidence constraints is considered the main issue.

4.9 Some of the Extracting Results from the New E-mall System

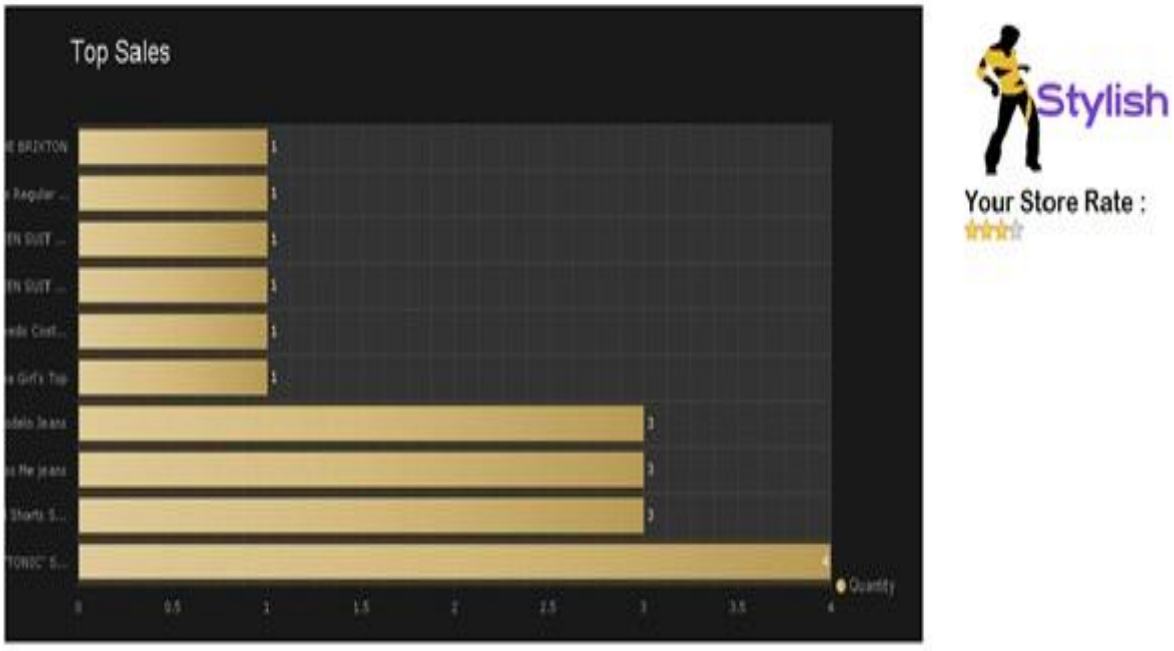


Figure 4-14: Sales improvements recommendation.

Figure 4-15: Top E-mall stores.

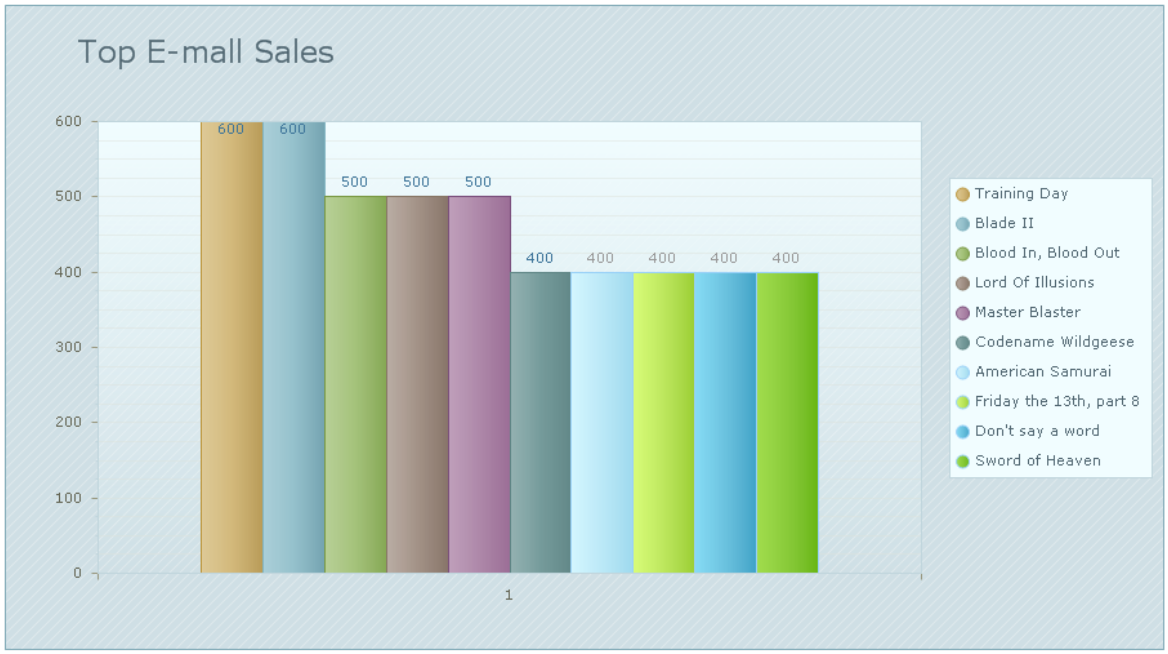


Figure 4-16: Top E-mall Sales.

Figure 4-17: Top E-mall stores.

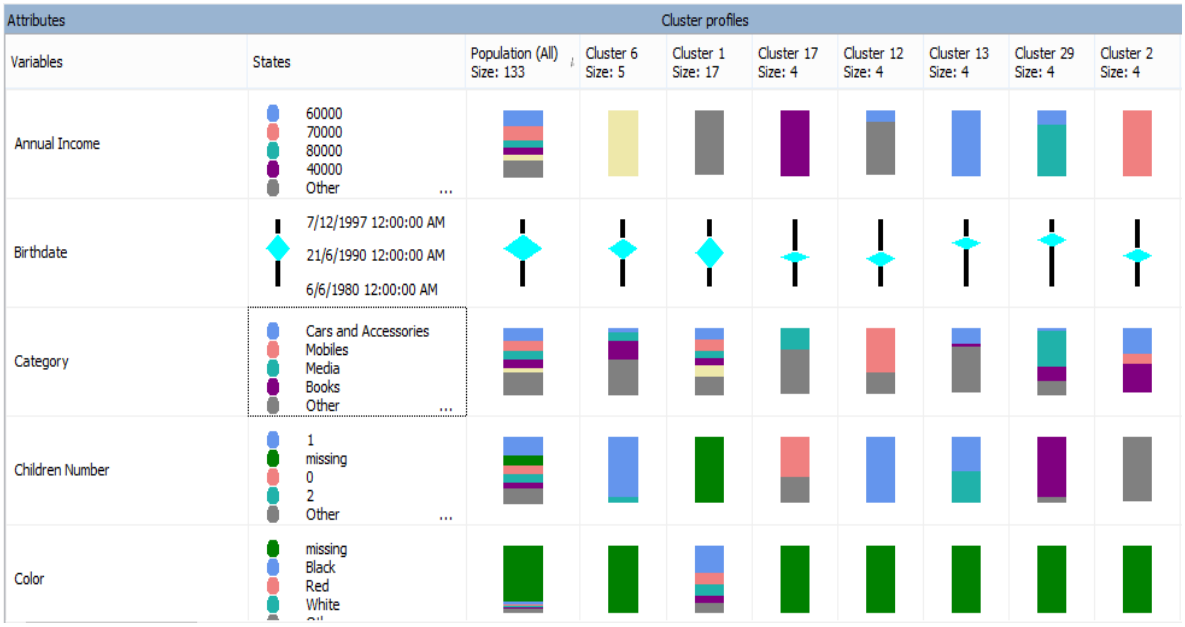


Figure 4-18: User clusters example.

Table 4-1: Comparative results between the proposed E-mall system with others.

recommendation	Behaviors	Intelligence search	Building rules	Fuzzy profile	Click	Rating	
no	no	no	no	no	4- clicks	yes	Ali express
no	no	no	no	no	5- clicks	yes	Ebay
no	no	yes	no	no	5-clicks	yes	Amazon
no	no	yes	no	no	7- clicks	yes	Bestbuy
no	no	yes	no	no	5- clicks	no	Walmart
yes	yes	yes	yes	yes	3- clicks	yes	Proposed E-Mall system

Summary of the Chapter

This chapter contends the deep details about the overall proposed system and shows the overall information about the system and the proposed fuzzy framework, which include the fuzzy dimension, fuzzy sets, fuzzy rule and fuzzy logic. Then discuss how builder the e-mall fuzzy rule based system rules, which are including the fuzzification, inference, composition and defuzzification. Before we create the customer profiling using deserialization to convert them from binary to the original fuzzy object with all of its values and features when retrieving them back from the database in the code. Finally, the proposed system used the data mining to analysis and discovery the customer profiling to get the optimal results, using tree types of algorithms, such as classification algorithm, clustering algorithm and association algorithm.

Chapter 5
Conclusion and Future Works

5.1 Conclusion of this Thesis

Implementation of the thesis has been completed in all its clauses. The profiling process using the fuzzy rule based system showed good results after testing it on a sample of users. The new proposed fuzzy framework, which include the fuzzy dimension, fuzzy sets, fuzzy rule and fuzzy logic. Then build the E-mall fuzzy rule based system rules, which are including the fuzzification, inference, composition and defuzzification. The customer profiling using deserialization to convert them from binary to the original fuzzy object with all of its values and features when retrieving them back from the database in the code. Finally, the proposed system have been applied on the data mining to analysis and discovery the customer profiling to get the optimal results, using tree types of algorithms, such as classification algorithm, clustering algorithm and association algorithm, and it showed good prediction and recommendation results as planned. The thesis is now able to be more developed with more enhancements and new ideas, or to be published as an end user product.

Future Works

As a future work, Profile building can be improved by increasing the profiling's variables and tracking's variables such like (willing to online payment, skills and individual characteristics, favorite sport etc.)

Also market segmentation can be improved by adding psychographic segmentation beside E-mall demographic segmentation such like (social class, usage rates and periods).

Integrating social networks to improve customer profiling by getting access to the social profile information (Facebook, Twitter).

More administration access and monitoring over the system website.

For Android mobile application adding more services for customers, will increase usage and application spread such like (view old paid orders, saving many shopping cart, view what's ordered in my location, etc.) and improve stability, performance and speed to get the most user satisfaction.

Implementing ACO machine learning algorithm on the fuzzy rules, to learn from the written rules in the database, and to generate new ones.

Developing an iPhone application serving iPhone mobile users.

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Appendix A

Implementations and Results

A.1 Introduction

In this chapter, will discuss some of the important results and shows the overall information and screenshots for how to use the proposed system, which include the Android Application Screenshots and Website Screenshots.

A.2 Android Application Screenshots:

Figure A-1: Android Login Screenshot Part 1

Figure A-2: Android Registration

This figure show the way how the user login to the mobile application, using his own information such as name, password, Email, birthday, gender and other information. Furthermore, the user will be able to login to the system, as showing in figure 4.1and 4.2.

Figure A-3: Android Registration Part 2 Screenshot

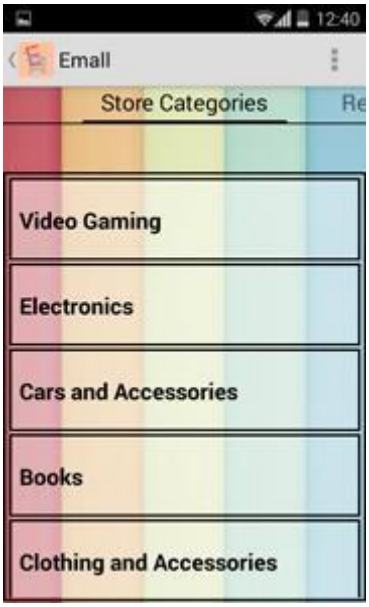


Figure A-4: Android Categories Screenshot

Figure A-5: Android You May Like Screenshot

Figure A-6: Android Recommendation Screenshot

Figure A-7: Android Store Products Screenshot

Figure A-8: Android Product Screenshot

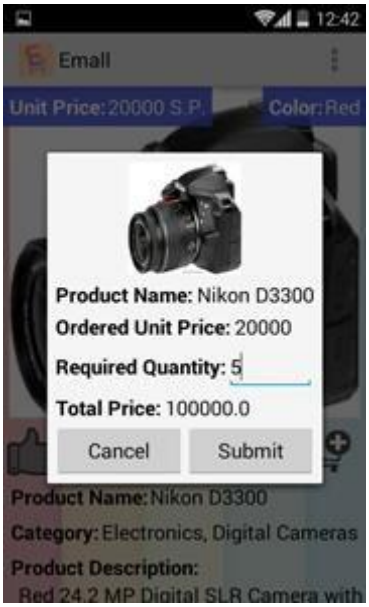


Figure A-9: Android Product Comments Screenshot

Figure A-10: Android Product Order Screenshot

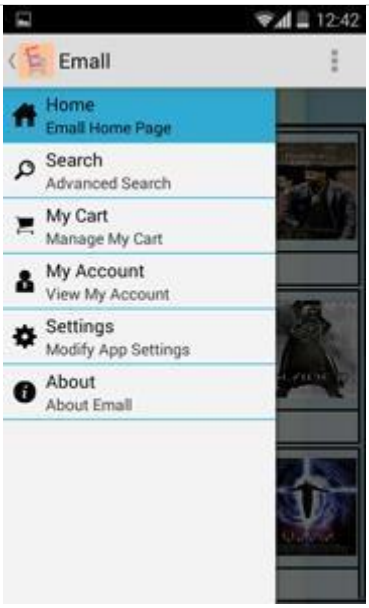


Figure A-11: Slide Menu Screenshot

Figure A-12: Android Top Search Screenshot

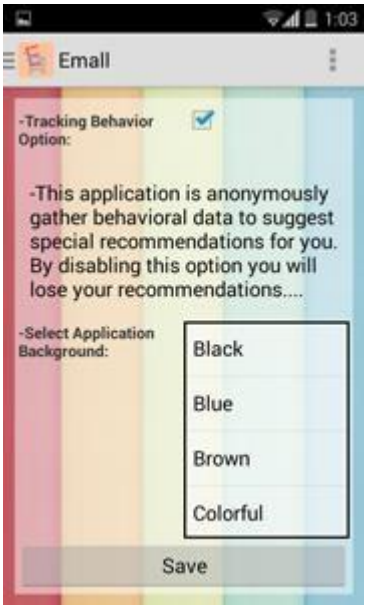
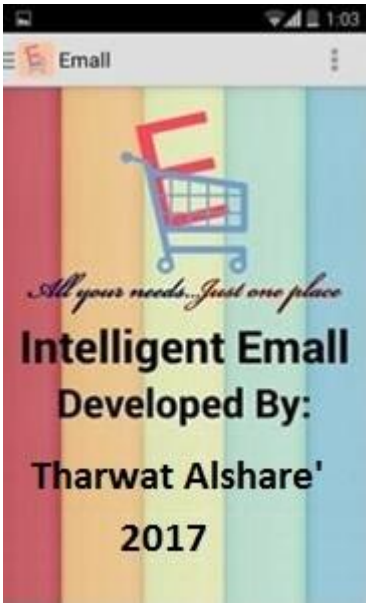


Figure A-13: Android Search Screenshot

Figure A-14: Android Settings Screenshot



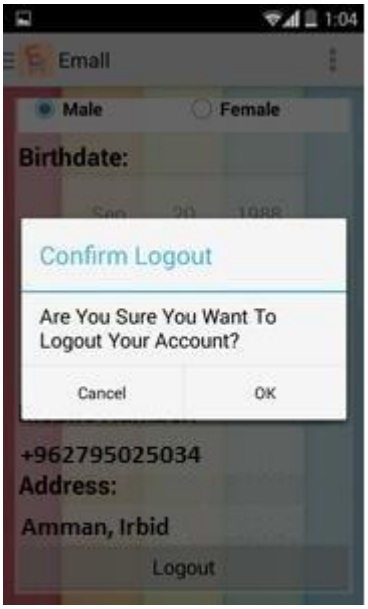


Figure A-15: Android about Screenshot

Figure A-16: Android Logout Screenshot

Figure A-17: Android Account Screenshot

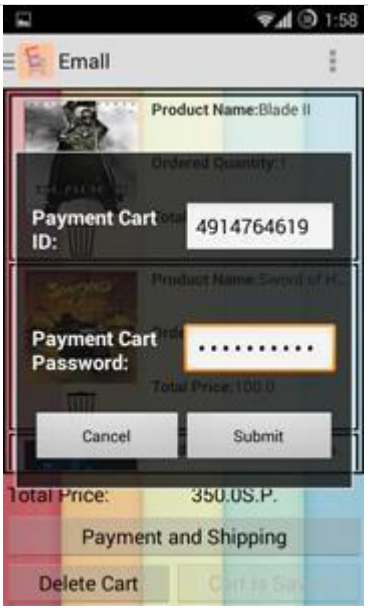


Figure A-18: Android Payment Screenshot

Figure A-19: Shopping Cart Screenshot

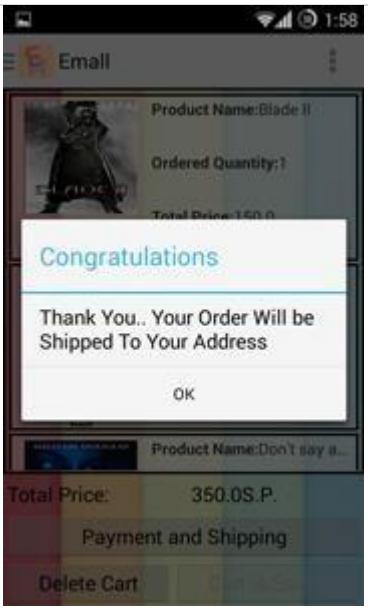


Figure A-20: Payment Done Screenshot

Figure A-21: Change Background Color Screenshot

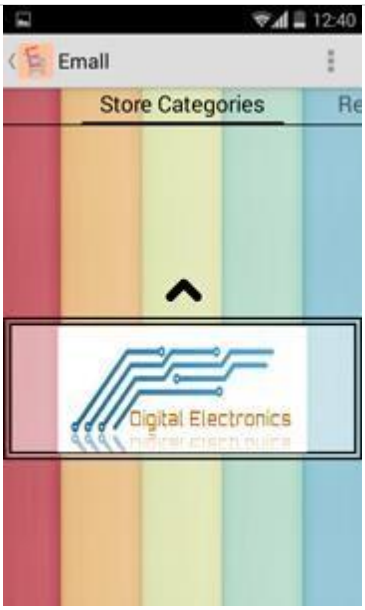


Figure A-22: Store Screenshot

Figure A-23: Android Rate Store

A.3 Website Screenshots

Figure A-24: Website Main Welcome Page Screenshot

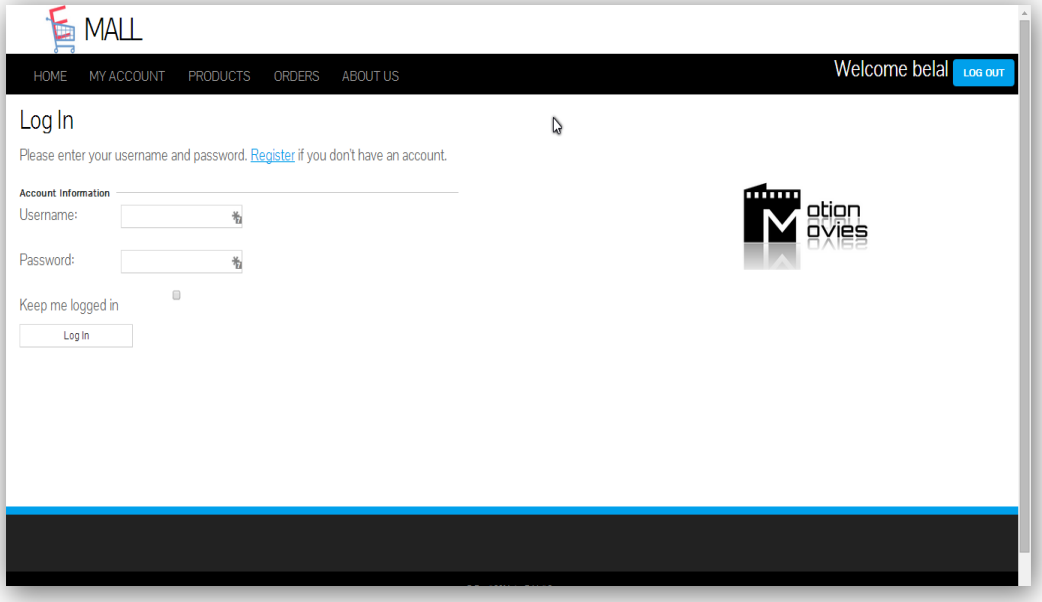


Figure A-25: Website Login Page Screenshot

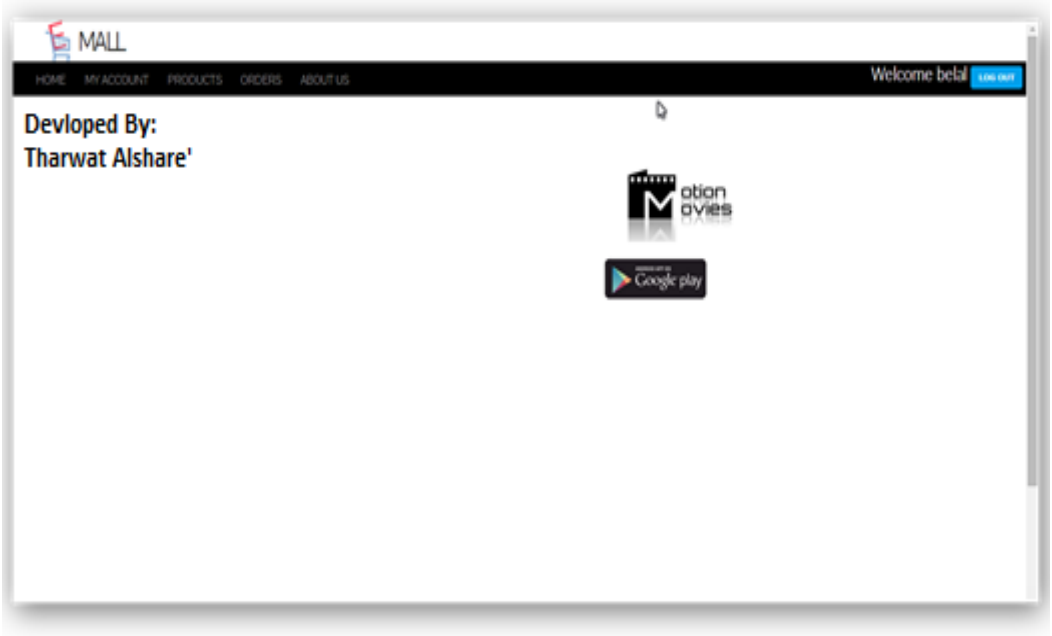


Figure A-26: Website about us Page Screenshot

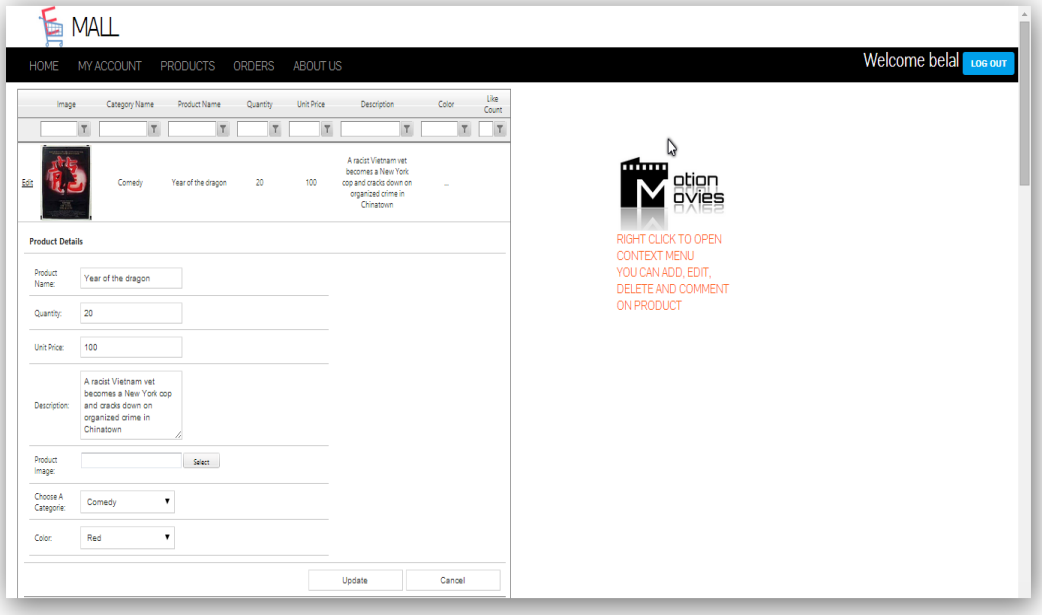


Figure A-27: Website Seller Edit Products Page Screenshot

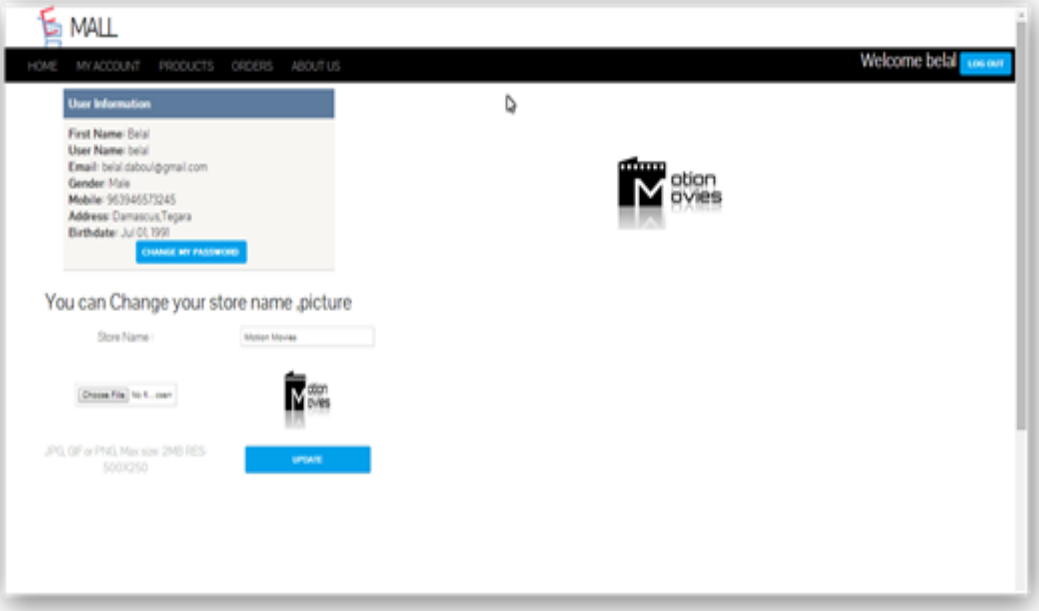


Figure A-28: Website Seller Account Page Screenshot

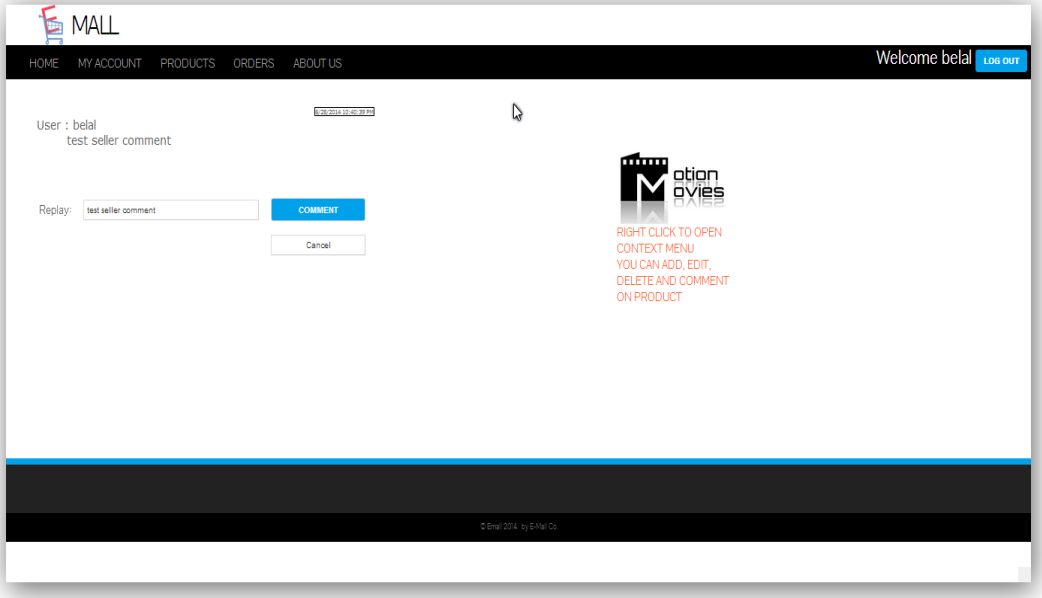


Figure A-29: Website Seller Post Comments Page Screenshot

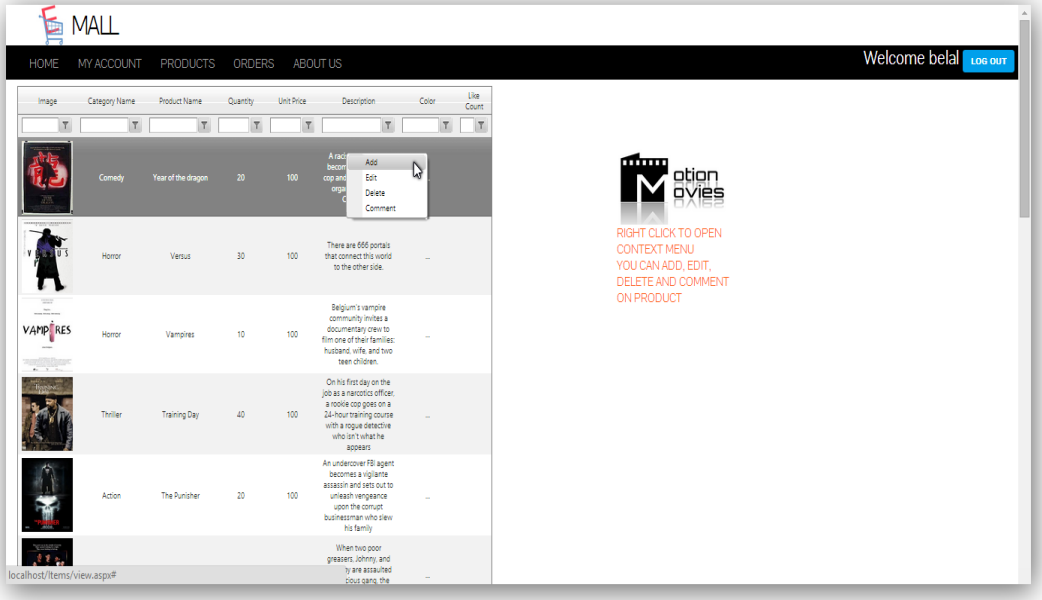


Figure A-30: Website Seller Products Management Page Screenshot

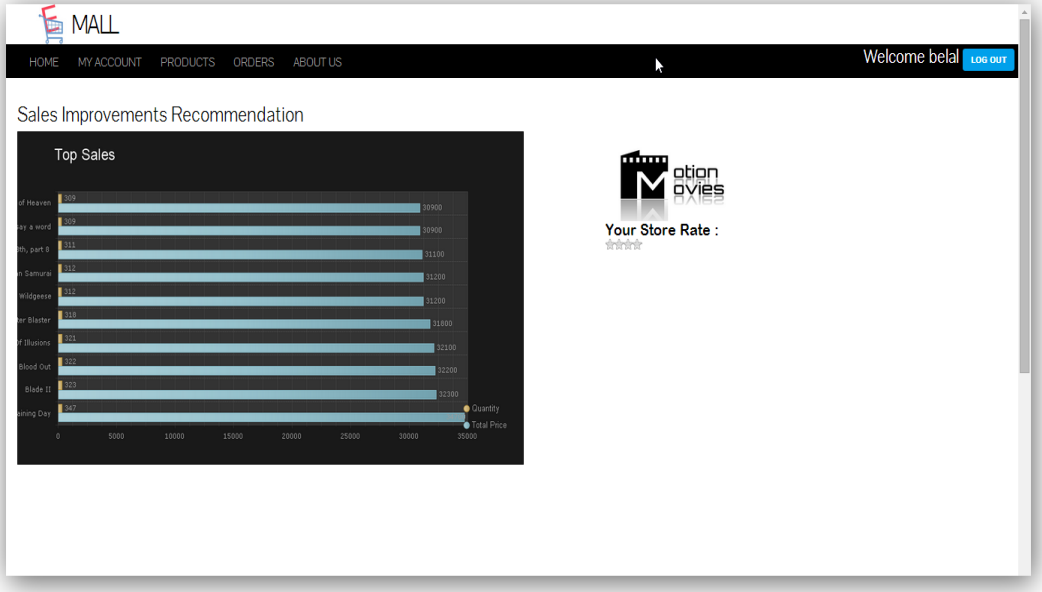


Figure A-31: Website Seller Top Sales Page Screenshot

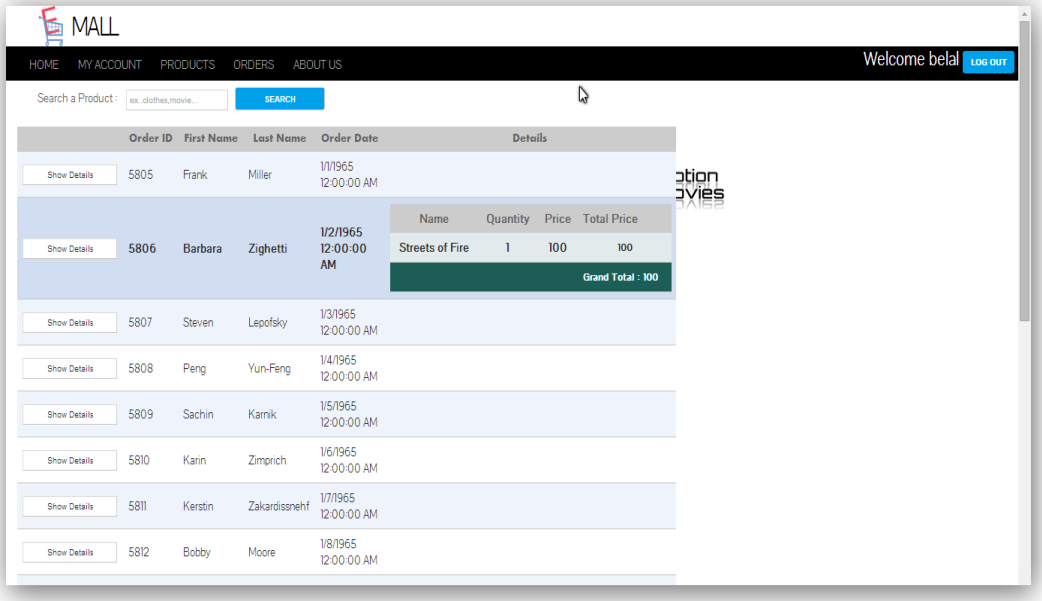


Figure A-32: Website Seller View Order Details Page Screenshot

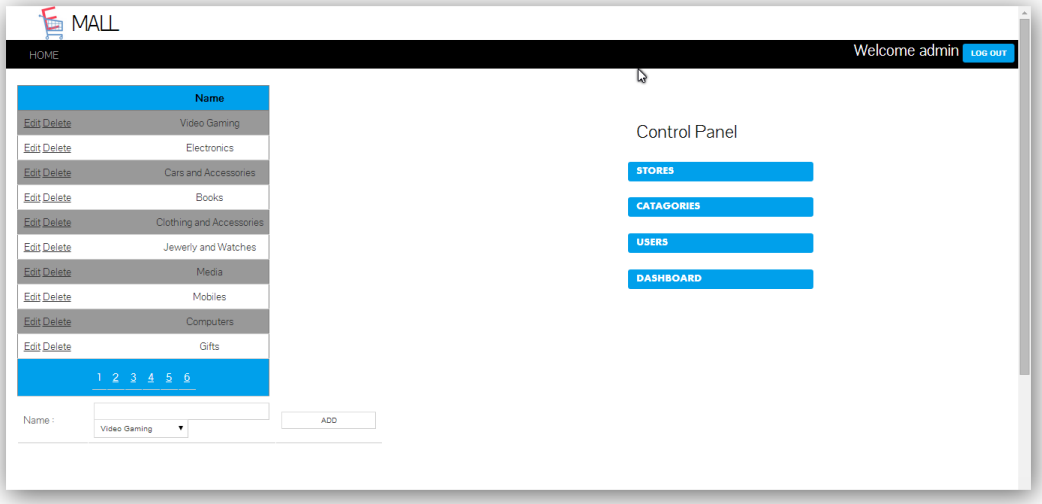


Figure A-33: Website Administrator Categories Management Page Screenshot

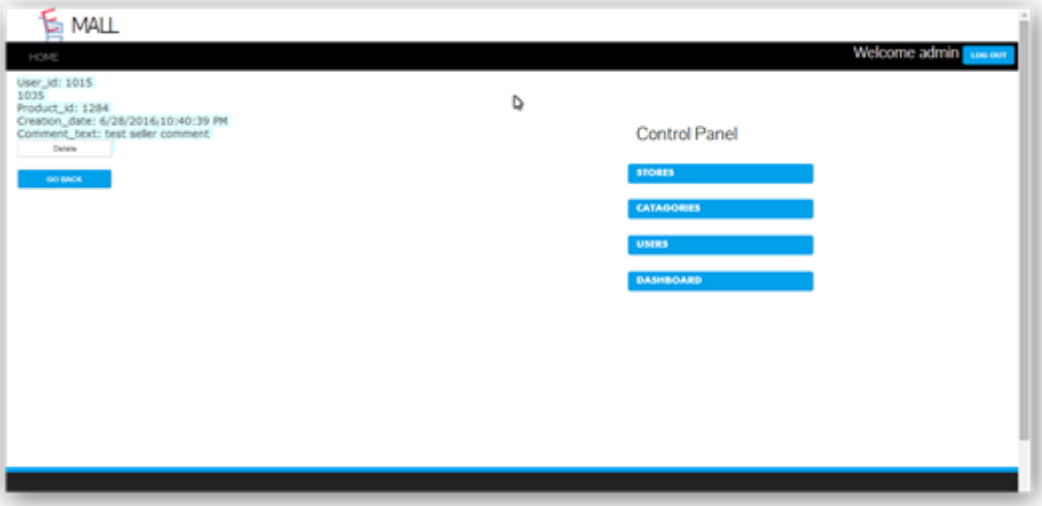


Figure A-34: Website Administrator Comments Management Page Screenshot

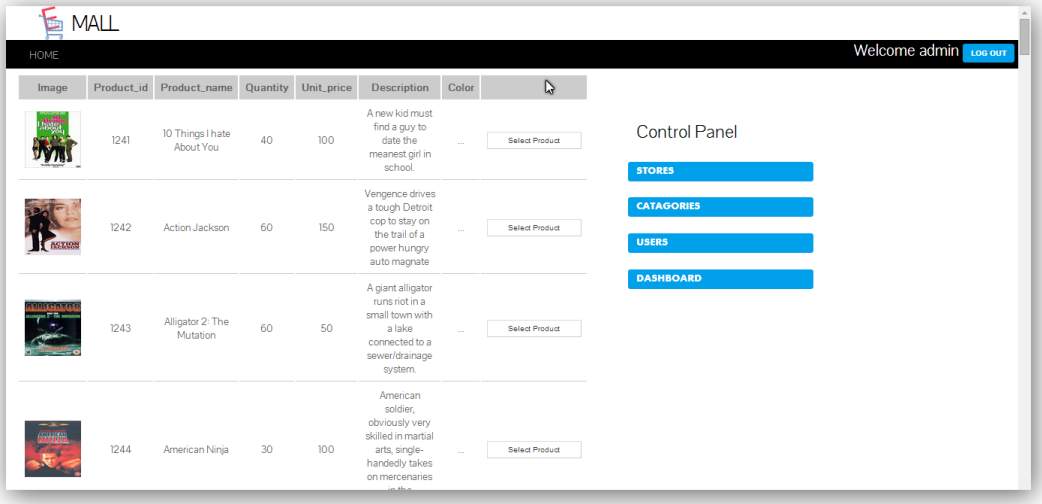


Figure A-35: Website Administrator Products Management Page Screenshot

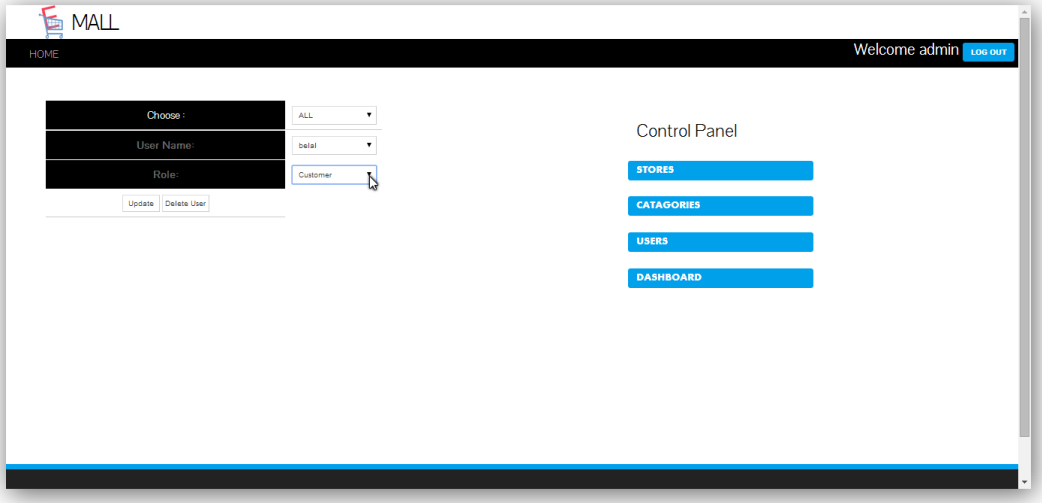


Figure A-36: Website Administrator Users Roles Management Page Screenshot

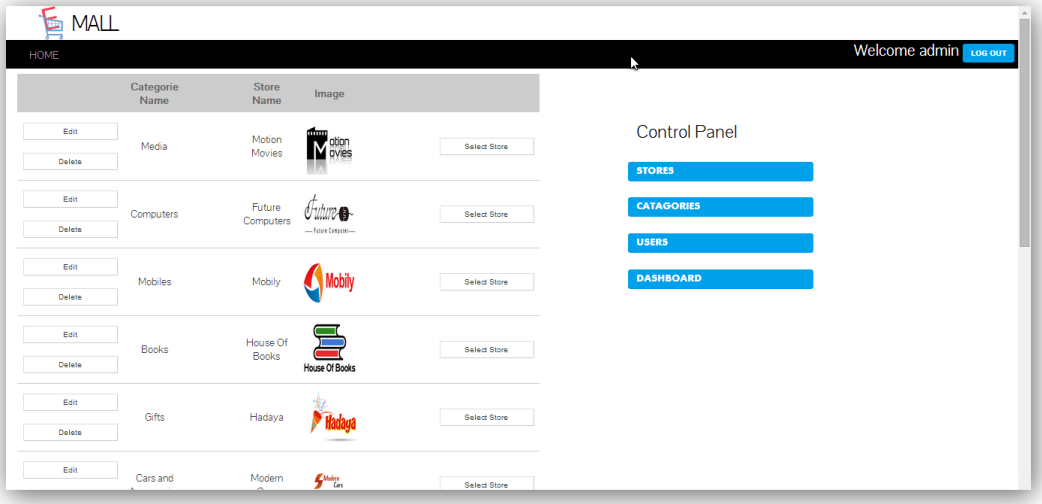


Figure A-37: Website Administrator Stores Management Page Screenshot

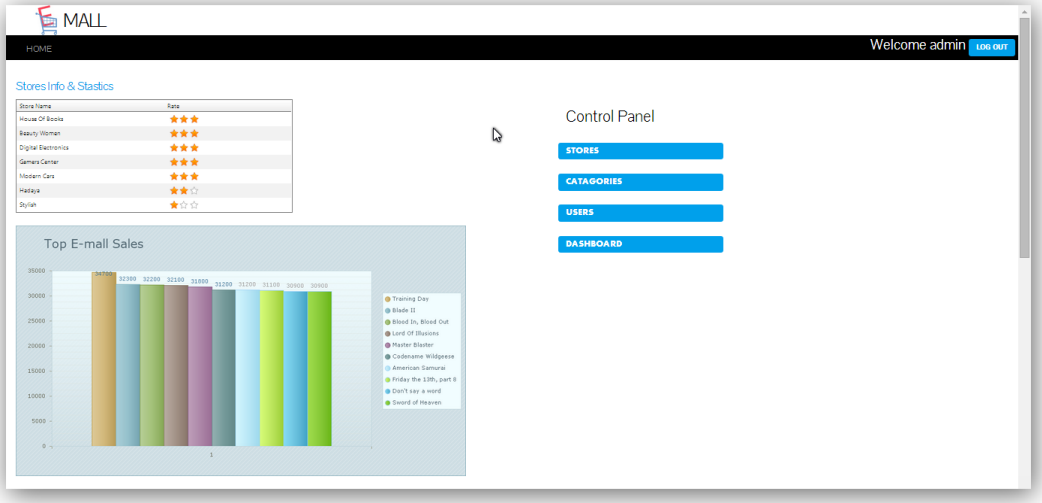


Figure A-38: Website Administrator Mall Statistics 1 Page Screenshot

Figure A-39: Website Administrator Mall Statistics 2 Page Screenshot

PPENDIX B

B.1 Fuzzy framework

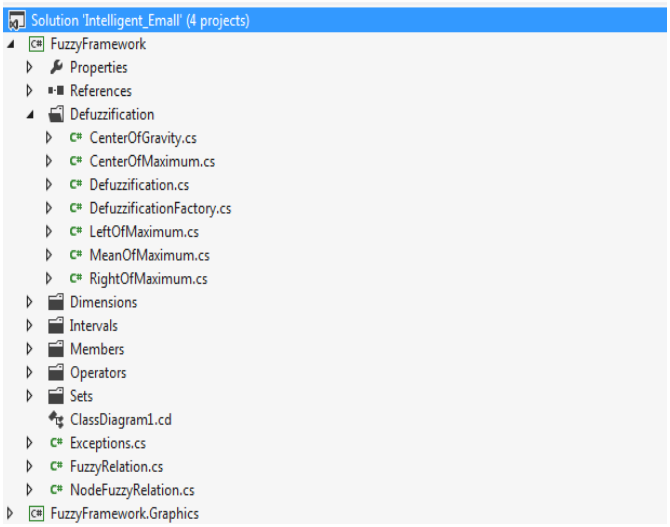


Figure B-1: Fuzzy framework

B.2 ADD Fuzzy variables

```
protected void fuzzyvariable_Click(object sender, EventArgs e)
    {
        try
        {
            string name = vname.Text.ToString();
```

```
            string desc = description.Text.ToString();

            string un = unit.Text.ToString();

            Decimal r = 0;

            Decimal.TryParse(min.Text.ToString(), out r);

            Decimal r2 = 0;

            Decimal.TryParse(max.Text.ToString(), out r2);

            ContinuousDimension height = new ContinuousDimension((string)name,
(string)desc, (string)un, r, r2);

            BinaryFormatter formatter = new BinaryFormatter();

            MemoryStream memorystream = new MemoryStream();

            formatter.Serialize(memorystream, height);

            string a = "";

            System.Configuration.Configuration rootWebConfig =
System.Web.Configuration.WebConfigurationManager.OpenWebConfiguration("/");

            System.Configuration.ConnectionStringSettings connString;

            if (rootWebConfig.ConnectionStrings.ConnectionStrings.Count > 0)

            {

               connString
```

```
= rootWebConfig.ConnectionStrings.ConnectionStrings["EmallConnectionString"];
            if (connString != null)
            {
                a = connString.ConnectionString;
            }
            else
                a = null;
        }
        SqlConnection conn = new SqlConnection(a);
        conn.Open();
        string queryStmt = "INSERT INTO Fuzzy_variable (Variable_name, Description, Unit, Min, Max, ob) VALUES ('" + name + "','" + desc + "','" + un + "','" + r + "','" + r2 + "',@o)";
        SqlCommand cmd = new SqlCommand(queryStmt, conn);
        SqlParameter param = cmd.Parameters.Add("@o", SqlDbType.VarBinary);
        param.Value = memorystream.ToArray();
        cmd.ExecuteNonQuery();
        Label1.Visible = true;
```

```
            Label1.Text = "Done";
            Label1.ForeColor = System.Drawing.Color.Green;
            DetailsView1.DataBind();
            DetailsView2.DataBind();
            conn.Close();
            DropDownList1.DataBind();
        }
        catch (Exception ee)
        {
            Label1.Visible = true;
            Label1.Text = ee.Message.ToString();
            Label1.ForeColor = System.Drawing.Color.Red;
        }
```

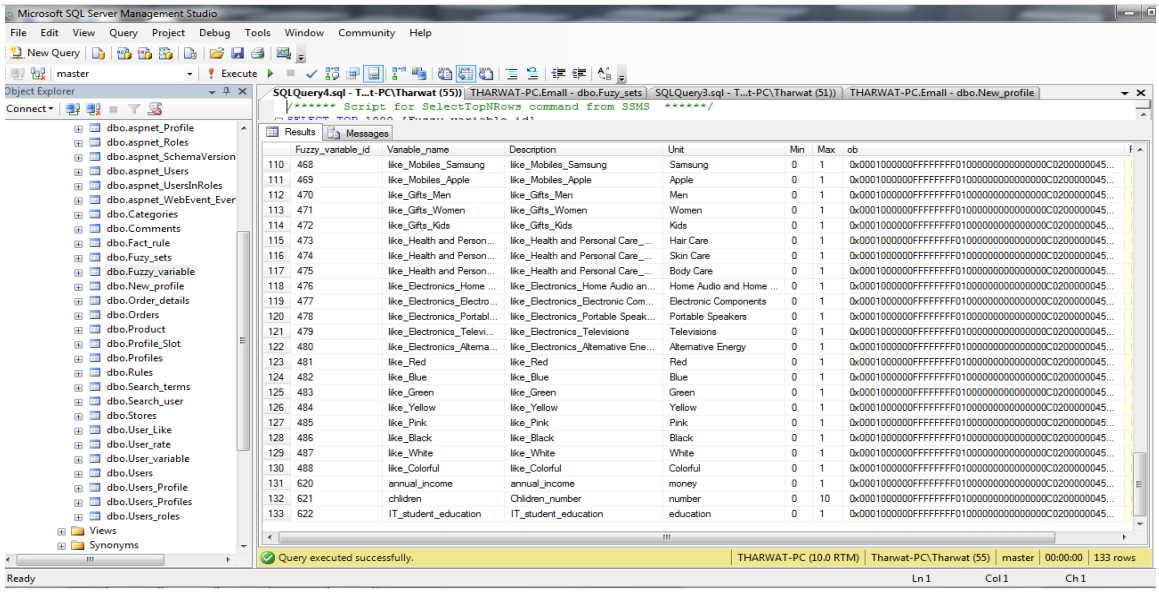


Figure B-2: Fuzzy variables

B.2 Add Fuzzy Set

```
protected void fuzzyset_Click(object sender, EventArgs e)
    {
       try
       {
          #region Definitions and connction string
          string name = fuzzysetname.Text.ToString();
          string Dimns = DropDownList1.SelectedValue.ToString();
          string Capti = Caption.Text.ToString();
```

```
string support = supportBound.Text.ToString();

string kernal = kernalBound.Text.ToString();

string a = "";

System.Configuration.Configuration rootWebConfig = System.Web.Configuration.WebConfigurationManager.OpenWebConfiguration("/");

System.Configuration.ConnectionStringSettings connString;

if (rootWebConfig.ConnectionStrings.ConnectionStrings.Count > 0)

{

   connString = rootWebConfig.ConnectionStrings.ConnectionStrings["EmallConnectionString"];

   if (connString != null)

   {

      Console.WriteLine("EmallConnectionString connection string = \"{0}\"", connString.ConnectionString);

      a = connString.ConnectionString;

   }

   else

      a = null;

   Console.WriteLine("No EmallConnectionString connection string");
```

```
            }

            SqlConnection conn = new SqlConnection(a);

            #endregion

            conn.Open();

            #region retrive dimnsion from database

            String sqlc = "SELECT Fuzzy_variable_id, Variable_name, Description,
Unit, Min, Max, ob FROM  Fuzzy_variable WHERE (Fuzzy_variable_id = '" + Dimns
+ "')";

            SqlCommand s = new SqlCommand(sqlc, conn);

            SqlDataReader sdr = s.ExecuteReader();

            byte[] data = new byte[byte.MaxValue];


            while (sdr.Read().Equals(true))

            {

                data = (byte[])sdr.GetSqlBytes(6).ToSqlBinary();

            }

            #endregion

            sdr.Close();
```

```
#region Insert fuzzyset


BinaryFormatter deselizer = new BinaryFormatter();

ContinuousDimension x = deselizer.Deserialize(new MemoryStream(data)) as ContinuousDimension;

FuzzySet y = null;

string queryStmt = "";

if (DropDownList2.SelectedValue == "1")

{

   Decimal r = 0;

   Decimal.TryParse(support, out r);

   Decimal r2 = 0;

   Decimal.TryParse(kernal, out r2);

   y = new LeftLinearSet(x, Capti, r, r2);

   queryStmt = "INSERT INTO Fuzy_sets  (Name, Fuzzy_type, Caption,

   queryStmt = "INSERT INTO Fuzy_sets  (Name, Fuzzy_type, Caption, supportBound, kernalBound, Fuzzy_variable_id, ob) VALUES ('" + name + "','RightLinearSet','" + Capti + "','" + r + "','" + r2 + "','" + Dimns + "',@o)";

}
```

```
else if (DropDownList2.SelectedValue == "3")
{
    Decimal r = 0;
    Decimal.TryParse(support, out r);
    Decimal r2 = 0;
    Decimal.TryParse(kernal, out r2);
    Decimal m = 0;
    Decimal.TryParse(mink.Text, out m);
    Decimal m2 = 0;
    Decimal.TryParse(mins.Text, out m2);
    y = new TrapezoidalSet(x, Capti, m, r2, m2, r);
    queryStmt = "INSERT INTO Fuzy_sets  (Name, Fuzzy_type, Caption, supportBound, kernalBound,supportBound_min,kernalBound_min, Fuzzy_variable_id, ob) VALUES ('" + name + "','TrapezoidalSet','" + Capti + "','" + r + "','" + r2 + "','" + m2 + "','" + m + "','" + Dimns + "',@o)";
}
if (queryStmt != "")
```

```
            {


                SqlCommand cmd = new SqlCommand(queryStmt, conn);

                SqlParameter param = cmd.Parameters.Add("@o",
SqlDbType.VarBinary);

                BinaryFormatter formatter = new BinaryFormatter();

                MemoryStream memorystream = new MemoryStream();

                formatter.Serialize(memorystream, y);

                param.Value = memorystream.ToArray();

                cmd.ExecuteNonQuery();

                DetailsView1.DataBind();

                DetailsView2.DataBind();

                DropDownList1.DataBind();

                Label1.Visible = true;

                Label1.Text = "Done";

                Label1.ForeColor = System.Drawing.Color.Green;

            #endregion

                conn.Close();
```

```
        catch (Exception ee)
        {
            Label1.Visible = true;
            Label1.Text = ee.Message.ToString();
            Label1.ForeColor = System.Drawing.Color.Red;
        }
    }
```

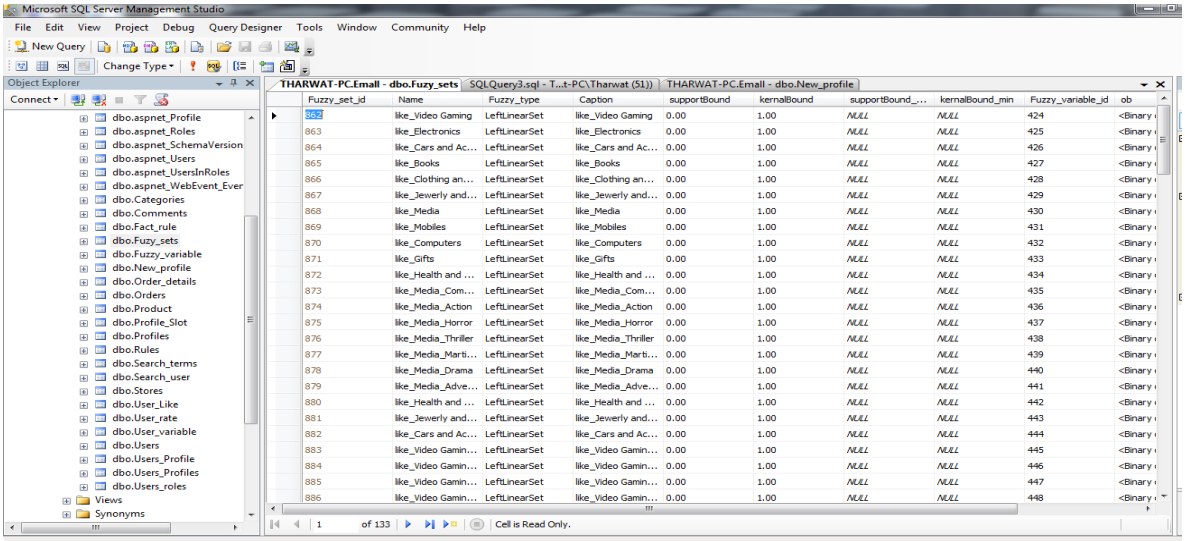


Figure B-3: Fuzzy Set

B.3 Serialization

```
using System.Runtime.Serialization.Formatters.Binary;
formatter.Serialize(memorystream, y);
```

B.4 Deserialization

```
BinaryFormatter deselizer = new BinaryFormatter();

ContinuousDimension x = deselizer.Deserialize(new MemoryStream(data)) as ContinuousDimension;
```

B.5 Defuzification

```
using System;

using System.Linq;

using System.Text;

using FuzzyFramework.Dimensions;

using System.Collections.Generic;

namespace FuzzyFramework.Defuzzification

    public abstract class Defuzzification

        protected IDimension _outputDimension;

        protected FuzzyRelation _relation;

        protected Dictionary<IDimension, System.Decimal> _inputs;

        /// <summary>
```

```
/// Defuzzifies the specified relation returning a crisp value for the specified inputs.

/// </summary>

/// <param name="relation">Fuzzy Relation to defuzzify</param>

/// <param name="inputs">Set of specified values for particular dimensions. There must be exactly one dimesion missing. This dimension will be used as the output dimension.</param>

public Defuzzification(FuzzyRelation relation, Dictionary<IDimension, System.Decimal> inputs)

{

    _relation = relation;

    if (inputs.Count < _relation.Dimensions.Length - 1) throw new ArgumentException(String.Format("Number of dimensions must be bigger than n-1, where n={0} is the total number of dimensions used in the relation.", relation.Dimensions.Length), "inputs");

    List<IDimension> dims = _relation.Dimensions.ToList<IDimension>();

    foreach (KeyValuePair<IDimension, System.Decimal> input in inputs)

    {

        //if (!dims.Contains(input.Key))
```

```
            //    throw new ArgumentException(String.Format("Dimension \"{0}\" does not exists in this relation.", input.Key), "inputs");

            if (dims.Contains(input.Key))

                dims.Remove(input.Key);

        }

        if (dims.Count > 1) throw new ArgumentException("There is more than one unspecified dimension left.", "inputs");

        if (dims.Count == 0) throw new ArgumentException("There are no unspecified dimensions left. The output function would be a constanct which can be obtained easier using the IsMember() method.", "inputs");

        _inputs = inputs;

        _outputDimension = dims[0];

        if (_outputDimension is IDiscreteDimension)

            throw new ArgumentException(String.Format("Continuous dimension expected as output dimension. Dimension \"{0}\" is discrete.", _outputDimension.Name));

    }

    /// <summary>
```

```
        /// Dimension which is used as the output. It has been specified as a missing input in the constructor.
        /// </summary>
        public IDimension OutputDimension
        {
            get
            {
                return _outputDimension;
            }
        }
        /// Set of specified values for particular dimensions.
        /// </summary>
        public Dictionary<IDimension, System.Decimal> Inputs
        {
            get
            {
```

```
            return _inputs;
        /// Fuzzy relation which is wrapped into this deffuzification object.
        /// </summary>
        public FuzzyRelation Relation
            get
                return _relation;
        /// <summary>
        /// The actual output of the defuzzification, depicted on the output dimension.
        /// </summary>
        public virtual decimal CrispValue
            get
            {
                throw new NotImplementedException();
            }
        }
```

/// Auxiliary information about Y-coordinate of the result, whereas CrispValue represents the X-coordinate.

```
/// </summary>
public virtual double MembershipDegree
{
get
   {
      throw new NotImplementedException();
protected decimal indecisiveResult()
{
   if (_outputDimension is IContinuousDimension)
      return (((IContinuousDimension)_outputDimension).MinValue + ((IContinuousDimension)_outputDimension).MaxValue) / 2;
   return 0;
```

B.6 Inference

```
protected static IOperator _instance = new AndM();
protected AndM() { }
public override string Caption { get { return "And m"; } }
public override string Description { get { return "Intersection implemented as min(μA (x),μB(x) ), xϵU"; } }
```

```
        public static IOperator Instance { get { return _instance; } }


        public override double Operate(double operand1, double operand2)
        {
            return Math.Min(operand1, operand2);
        }
        internal override void Operate(BinaryInterval operands, ref IntervalSet output)
        {
            GetMinMax(operands, ref output, true);
        }
Composition(relation.cs)
private FuzzyRelation _subrelation1;
        private FuzzyRelation _subrelation2;
        private IOperator _operator;


        public override bool Terminal { get { return false; } }
```

```
internal NodeFuzzyRelation( FuzzyRelation subrelation1, FuzzyRelation subrelation2, IOperator oper)
{
    if (
        subrelation1 == null ||
        //subrelation2 == null ||
        oper == null)
        throw new ArgumentNullException();
    _subrelation1 = subrelation1;
    _subrelation2 = subrelation2;
    _operator = oper;
    subrelation1.Parent = this;
    if (subrelation2 !=null)
        subrelation2.Parent = this;}
```

B.7 Retrieve old user profile, apply related fuzzy rules, and update it by applying the OR function between the old profile fuzzy variables and the new profile fuzzy variables.

```
FuzzyRelation r = list_of_relation[ j ];
```

SingletonSet st = new SingletonSet(r.Dimensions[0] as IContinuousDimension, "", value);

FuzzyRelation newff = r & st;

Dictionary<IDimension, decimal> der = new Dictionary<IDimension, decimal>(); der.Add(r.Dimensions[0], value); FuzzySet newf = newff.Project(der);

if (oldfz != null)

FuzzyRelation newfr = (oldfz | newf); der.Add(newfr.Dimensions[0], value);

FuzzySet newst = newfr.Project(der);

B.8 Update related color variable in user profile after making a like on a product with a specific color.

String proflir1 = @"SELECT Color FROM Product

WHERE (Product_id = '" + product_id + "')";

SqlCommand proflirr1 = new SqlCommand(proflir1, conn); string var1 = "";

SqlDataReader pro11 = proflirr1.ExecuteReader(); while (pro11.Read().Equals(true)) var1 = pro11.GetValue(0).ToString(); conn.Close();

bool bb = profiler(Convert.ToInt16(user_id), var1);

B.9 Assosiation rules(defults.aspx)

AdomdConnection conn1 = new AdomdConnection(a2);

conn1.Open();

System.Microsoft.AnalysisServices.System.DataMining.AssociationRules.GetRules('Orders',0,20,3,0.4,0.35,'',True)";

List<Dictionary<String, String>> orderd = new List<Dictionary<string, string>>(

B.10 Sample JAVA Code (Client Side):

Saving tracked items (object arrays) as JSON to shared preferences.

public static void saveTracking()

{

Gson gson = new GsonBuilder().create(); JsonArray tracked_products_json =

gson.toJsonTree(tracked_products).getAsJsonArray();

HashMap<String, String> map = new HashMap<String,String>(); map.put("tracked_products",tracked_products_json.toString()); Utilities.putSharedPreferancesValue("tracked_products", map.toString()); gson = new GsonBuilder().create();

JsonArray tracked_stores_json = gson.toJsonTree(tracked_stores).getAsJsonArray();

HashMap<String, String> map1 = new HashMap<String, String>(); map1.put("tracked_stores", tracked_stores_json.toString());

Utilities.putSharedPreferancesValue("tracked_stores", map1.toString()); }

Get store products from server.

```
static ArrayList<Product> getProducts(String store_id)

{

if (utilities.isOnline())

{ try

{

String url=String.format(Locale.getDefault(),

"%s/api.ashx?s=5&i=%s",MainActivity.LOCALHOST_S,store_id);  url=url.replace("
", "+");

JSONObject json = jParser.getJSONFromUrl(url); JSONArray products_json = null;
products_json = json.getJSONArray("Products"); products = new
ArrayList<Product>(); for(int i=0 ; i<products_json.length() ; i++)

JSONObject c = products_json.getJSONObject(i);

if(c.getString("Store_id").equals(store_id))

Product pr =new

Product(c.getString("Product_id"),c.getString("Store_id"),c.getString("Category_id")
,
c.getString("Product_name"),c.getInt("Quantity"),c.getDouble("price"),c.getString("d
escription"),c.getString("Addition_date"),c.getString("Like_count"),c.getString("Ima
ge_url"),c.getString("coumments_count"),c.getString("Color")); products.add(pr);
```

}}} catch(Exception e) {}} else { utilities.requestConnection(context); products = new ArrayList<Product>(); }

return products; }

B.11 Sample DMX Query:

Predicting 3 associated with a given product using association rules. select flattened predict([userorer],3) from [Users] natural prediction join

(select

(select " + Product_id + " as [Item Id]) as [userorer]) as t

Call the stored procedure to Return the rules for top 20 associated products.

CALL

System.Microsoft.AnalysisServices.System.DataMining.AssociationRules.GetRules(' Users',0,19,3,0.4,0.35,'',True)

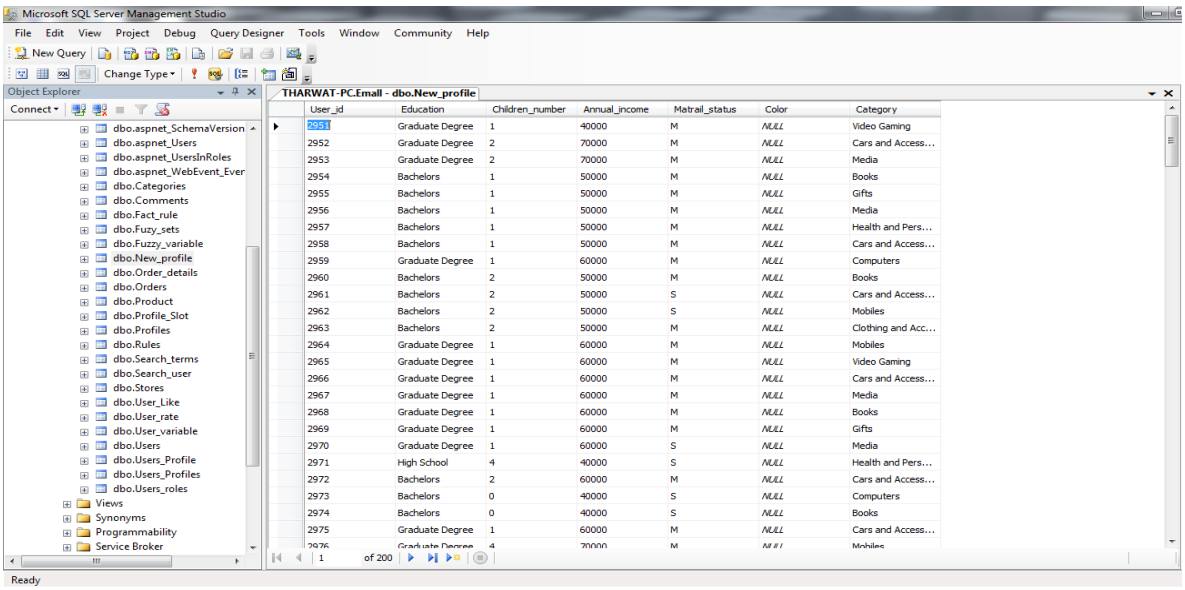


Figure B-4: Customer Profile

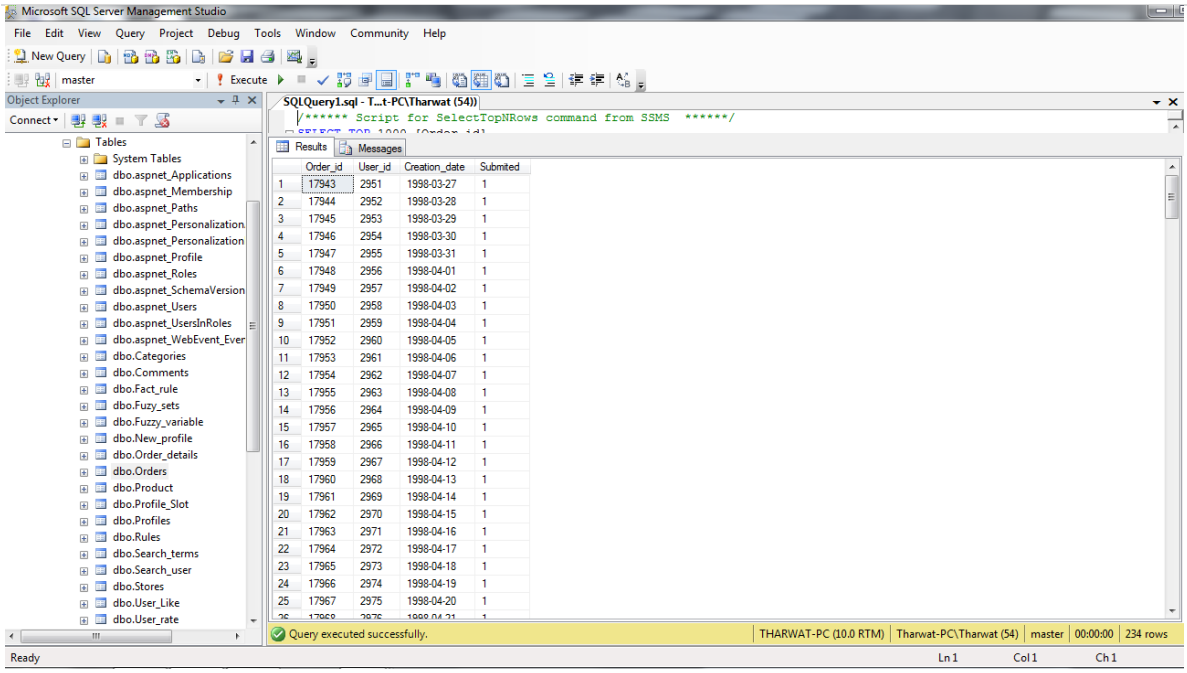
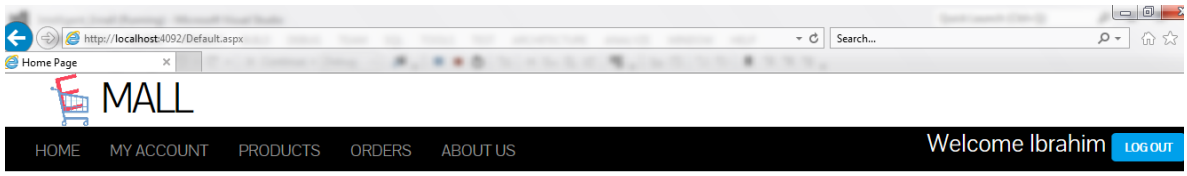


Figure B-5: Order



Best sold togather	First Product Name	Second Product Name	Third Product Name
1	Spiderman T-shirt and Shorts Set Boy's Combo		MISS ME Modelo Jeans
2	MISS ME Modelo Jeans		Miss Me jeans
3	Spiderman T-shirt and Shorts Set Boy's Combo	Miss Me jeans	MISS ME Modelo Jeans
4	MISS ME Modelo Jeans		Spiderman T-shirt and Shorts Set Boy's Combo
5			Spiderman T-shirt and Shorts Set Boy's Combo

Figure B-6: Result_Clustering

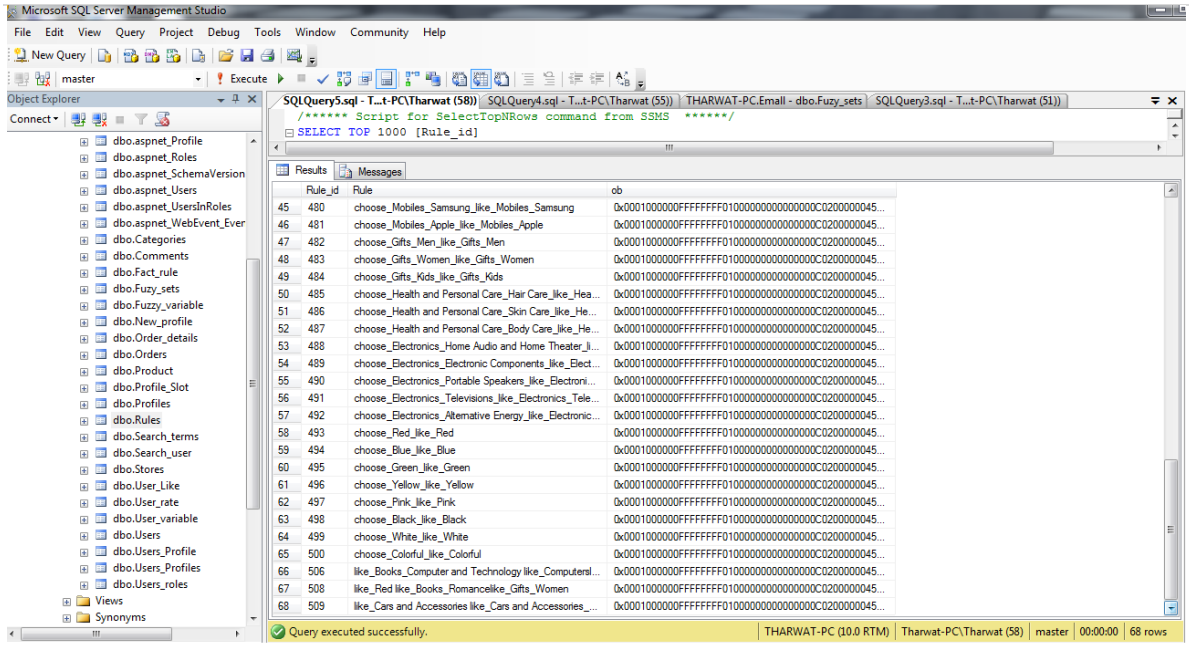


Figure B-7: The Fuzzy Rule

B.12 Core Classes

AboutMenu

CartListAdapter

CategoriesTab

Category

Comment

CommentsListAdapter

HomeMenu

JSONParser

MainActivity

MenuListAdapter

MyAccountMenu

MyCartMenu

OrderedProduct

PostOrder

PostTracking

Product

ProductActivity

ProductsListAdapter

RecommendedTab

SearchMenu

SettingsMenu

Store

StoresListAdapter

TopTab

TrackedItem

Utilities

ViewPagerAdapter

B.13 Some of Core Functions

private ArrayList<OrderedProduct> checkGetOrderedProducts()

private boolean validateLogin(String username, String password)

static ArrayList<Product> getProducts(String store_id)

private void checkPostTrackingRequired()

private void postTrackedItems()

private void getTrackingItems()

public void closeApp(boolean confirmation, final Context context)

public boolean isOnline()

public static String getSharedPreferancesValue(String key,String defaultvalue)

public static void putSharedPreferancesValue(String key,String value)

public Integer getAge(int year, int month, int day)

public Drawable loadImageFromWeb(String url)

public static void restartApplication()

public static void saveTracking()

private void getRecommendationsProducts()

private void getYouMayLikeProducts(String productID)

private void showMayLikeDialog()

private void saveColorToServer()

public static ArrayList<Product> getTopProducts()

static void showStoreInfoDialog(final String store_id)

private static boolean rateStore(String store_id,String rate)

static void showStoreInfoDialog(final String store_id)

private static void searchProductStore(String uSERID,String search_choice, String search_term,int save_search)

private void likeClick(String product_id)

static void trustAllHosts()

private void getUserInfo()

private static Double calculateTotalCart()

private void payForCart()

PostOrder(String urlString, String USERID, boolean SUBMITTED, ArrayList<OrderedProduct> ordered_products)

PostTracking(String urlString, String USERID,ArrayList<TrackedItem>

tracked_products,ArrayList<TrackedItem> tracked_stores)