Retail Management System

Project Da Vinci

ABSTRACT

Da Vinci
(The Retail Management System)

- **What is a Retail Management System?**
  - Retail Management System, actually, is a vast system comprising of various sub-systems such as customer side application, billing system, distribution and warehousing systems, employee scheduling software, store level management system, central system keeping reports of store.

- **What is the purpose of a Retail management system?**
  - It is an application which is mainly developed for the manager of a store which can be a stand-alone store or a part of the world-spread Retail Chain. Identical to the store level management system, software aids the store manager in keeping the track of products at store and in devising new and innovative strategies to achieve the target set for him by the higher management.
  - This Management Systems facilitates the store manager to see every current happenings in store at once. Assisting store manager to generate sales report and stock summary in a very easy and smooth manner is an important feature of the application. Also providing an interface so that the manager can place and/or view orders made to the inventory helps to manage the store products. The application also provides suggestions to achieve quarterly set goals, by using various complex data mining techniques over the data collected from the history of the store. Also the application allows the manager to take actions promptly by providing alerts for many predefined actions and unseen developments along with suggestions for the action that should be taken.
  - Billing system and Central inventory & management systems also works in correspondence with this application, and together they deploy services to the store manager. Billing system will generate transactions at the store for every purchases while central inventory & management system will serve the order placed and keep check on the finance of store.

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1. Introduction

1.1. Project Overview

- Retail Management System is a hybrid application- collection of various applications- which helps a store manager in managing products at the store. The application also makes use of various data mining techniques to display the past performance and forecast of products. Based on this evaluation, it provides suggestions so that store managers can device new strategies for achieving pre-defined targets.

1.2. Purpose

- To empower the store manager to grasp the circumstance of the store anytime by giving exact and redesigned data about the offers of items in distinctive easy to use format.
- To assist manager in making decision such as the products by categories to be ordered from the product warehouse , steps to be taken to achieve the targets, new schemes to be introduced and & how much time so the profit increases and in case of unforeseen alarming situation steps needed to be taken. Use of data mining techniques finds all new ways for the application to discover the hidden relation patterns between the sales and products. This also makes possible the forecast of the products` performance.

1.3. Project Scope

- **Technical Scope:** Any computer system with basic hardware can run this application
- **Business Scope:** Any store manager of a retail chain can use this application as the application can be modified as per the need and specifications.

1.4. Objective

- To give the store manager account of the current status of the store.
- To generate exact and uniform reports of sales in human understandable formats as per the specifications defined by the store manager.
- To sum up the products in stock and generate stock summary as per different criteria. Such as products by brands, for a certain time duration, products by the categories and sub-categories.
- To order products from warehouse.
- To check and recapitulate the orders placed previously and to check the current status of the order.
- To recommend and bring about combinatory schemes of different products.
- To recommend and bring about discounts on different products.
- To show past sale of products, equate them with their past sale and predict the sales of the products and advice what actions should be taken in order to achieve the target in the strict timeline.
- To notify manager about completion of any predefined task. Such as an order is dispatched from the warehouse or when there is any alarming situation and immediate steps are needed to be taken (For example, the quantity of particular product has dropped below the threshold limit and the manager is needed to place the orders as soon as possible.)
- To facilitate the manager with basic actions – download, print and email reports, summary and order.

2. The Game Changers

2.1. Major trends and enablers

2.1.1. Merchandise and Pricing

- With the growing customer needs and competition, it became mandatory to keep your store in the market and sustain the change in the modern buying and selling pattern.
- Nowadays, retail stores keep discounts, combo offers and many more attractive deals to catch big mass. Merchandise and pricing include standard product, refrigeration, Mass market products, demand for variety, commoditization, private brands, Mass customization.

2.1.2. Store Experience and customer satisfaction

- It is very eminent that a retailing store keeps their customer happy. To do that, they consider self-services, suburban life, automobiles, one stop shopping, services, online or virtual stores and pickup facilities.

2.1.3. Marketing approach

- Marketing is necessity to grow in the market where competition is increasing day by day. General marketing approaches consider print media, radio ads, TV ads, Fads and fashion, Global megabrands, EDLP and introduction of personalization online.

2.2. Techniques that changed the view

2.2.1. Sales forecasting

- Everyone in the world wants to be an oracle. But no one is capable of it. But a retail industry is. You can actually predict future with sales forecasting.
- To achieve that, you need big numbers of data and a big data warehouse.
- The sales forecast establishes the level of activity used in all the other forecasts and budgets for the business. If your sales forecast varies wildly from your actual results, your cash flow and profitability forecasts will similarly be inaccurate.
- Regularly updating forecasts ensures current market intelligence, buying signals from clients and the efforts behind the marketing strategy can be taken into account for the next forecast.

2.2.2. Data Mining

- Retail Management collects large amount of data in terms of product selling. Due to increasing ease, availability and popularity of the business conducted on web or e-commerce, this data is rapidly growing.
- With data mining techniques, large retailers started doing analysis on how they performed during a particular quarter and what factors can change the whole scenario in their benefit.
- Market basket analysis and Apriori algorithms helped overall analysis where how and what can be done was derived on the basis of what can be on the highest probability list.

3. Systems analysis & requirements definition

3.1. Hardware and software requirements

3.1.1. Software Requirement

- Operating System (Windows XP/Windows Vista/Windows 7/Windows 8) and .net framework.
- Web browser (Mozilla FireFox / Chrome).

3.1.2. Hardware Requirement

- There is no explicit hardware requirement.
- The system runs fine on dual core processors and with minimum of 4GB RAM.

3.1.3. Constraints

- **Hardware Limitations:** There is no hardware configuration required for this application.
- **Programming Language Requirements:** All complex requirements can be handled by the .NET Framework.
- **Internet connection:** This is a web based application and everything will be handled on the global database. Hence, a user must have internet connection all the time when he/she is using the application.

3.1.4. Assumptions and Dependencies

- Here, we assume that the user has all the basic requirements including hardware and software to deploy the application.
- The user also needs an internet connection to establish communication with the database.

4. System Design

- System design becomes into picture after we finish the requirement gathering. After designing the goals and use case activities, we have finalized modules and flows of the whole system.

4.1. Object Oriented Approach

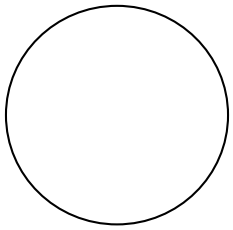
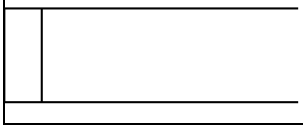
- Object oriented approach is very important when you develop a large system.
- Large and commercial systems often need dynamic changes and the requirement can vary a lot after going live.
- With object oriented approach we can implement the Abstraction, Inheritance and encapsulation.
- Interface design and class implementations help us to change the functionality later whenever new requirement comes into the picture.

4.2. Modules

- Since the project is scheduled to use OO concepts and designing patterns of GoF, it will be divided into independent modules so that the implementation of each module can be separated from each other.
- Also, Independent modules can be integrated in a better way and requirements can be easily mapped according to the costumer's need.
- Following modules will be used to create the whole working system:
  - Home Page
  - Sales Report
  - Stock Summary
  - Inventory
  - View Order
  - Strategy
  - Alerts
- Also, the system also has supporting modules which are also independent and supports the whole system to work in a better and an efficient way.
  - Central Inventory Manager
  - Billing Module

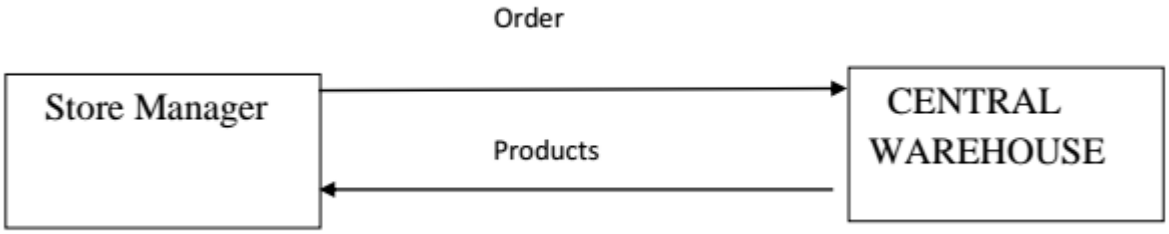
4.3. Data Flow Diagrams

- The symbols are used in DFD as follows:

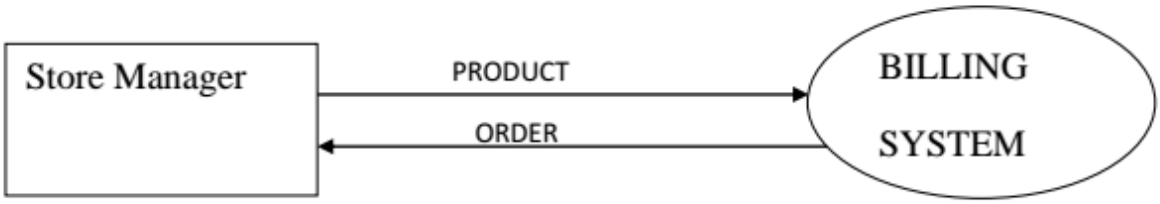
SYMBOLS	NAME	DESCRIPTION
	Data flow	Represents the connectivity between various processes.
	Process	Perform some processing of input data.
	External entity	Define source or Destination of system data.
	Data store	Repository of data.

4.3.1. 0 Level DFD

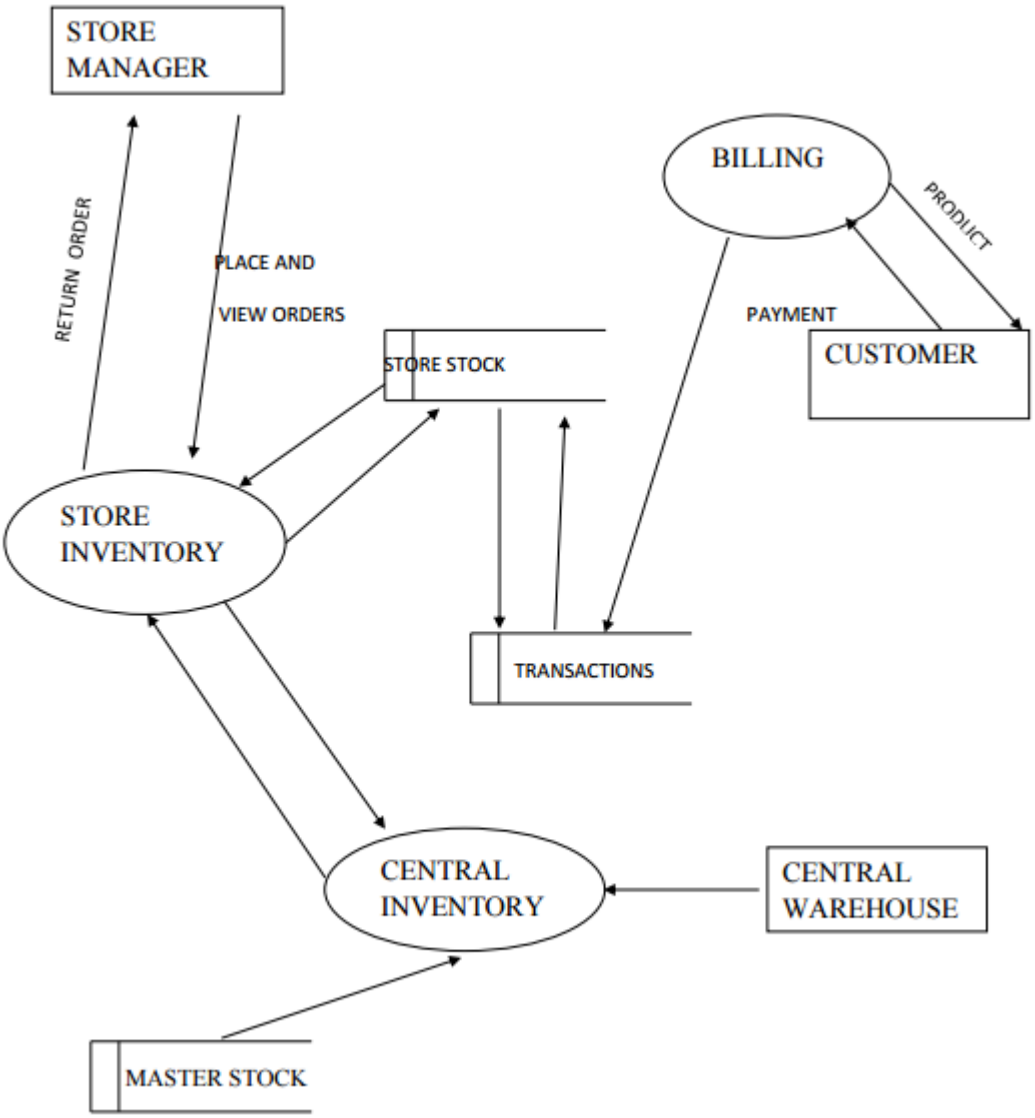
- DFD FOR STORE MANAGER AND CENTRAL WAREHOUSE



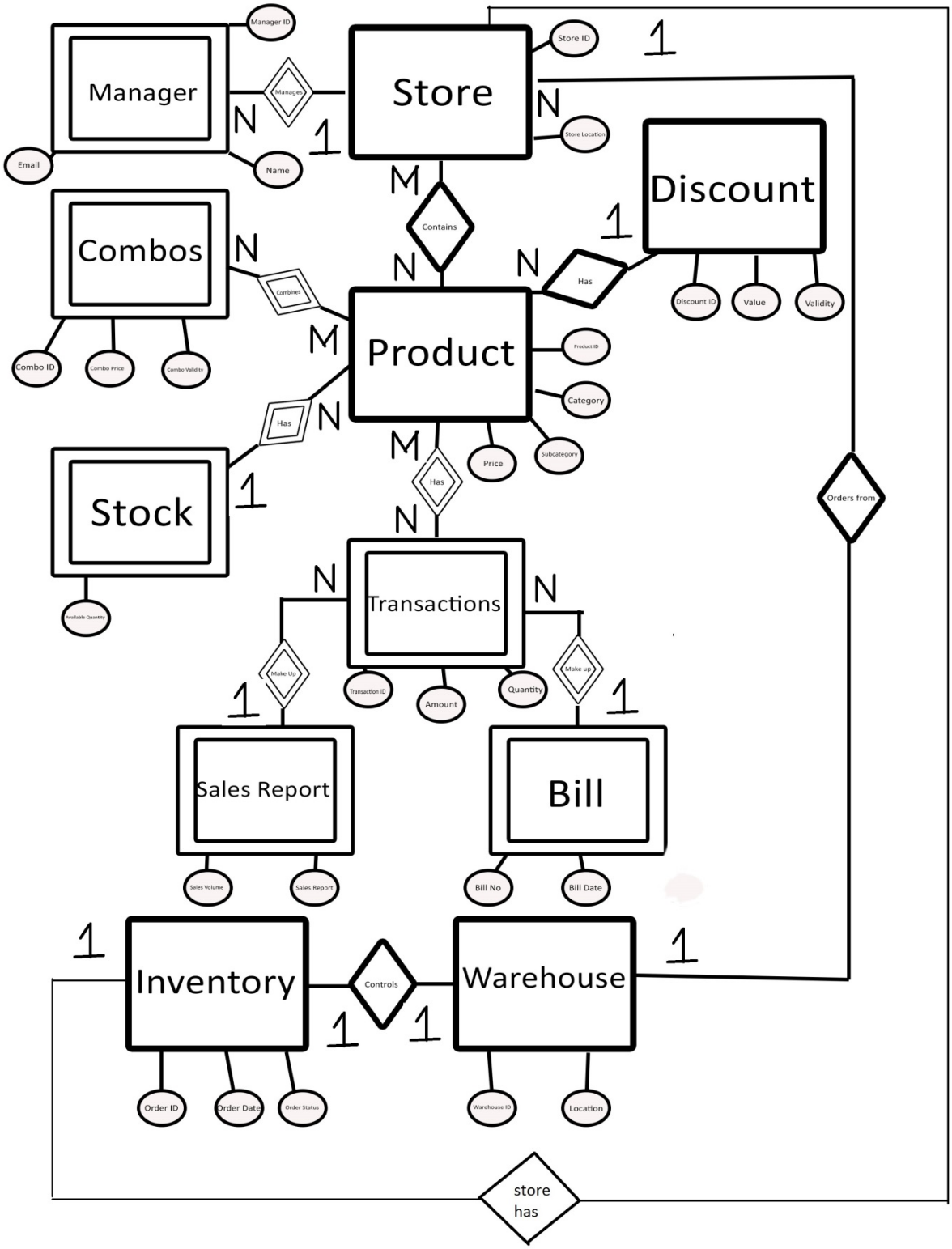
- DFD FOR STORE MANAGER AND BILLING



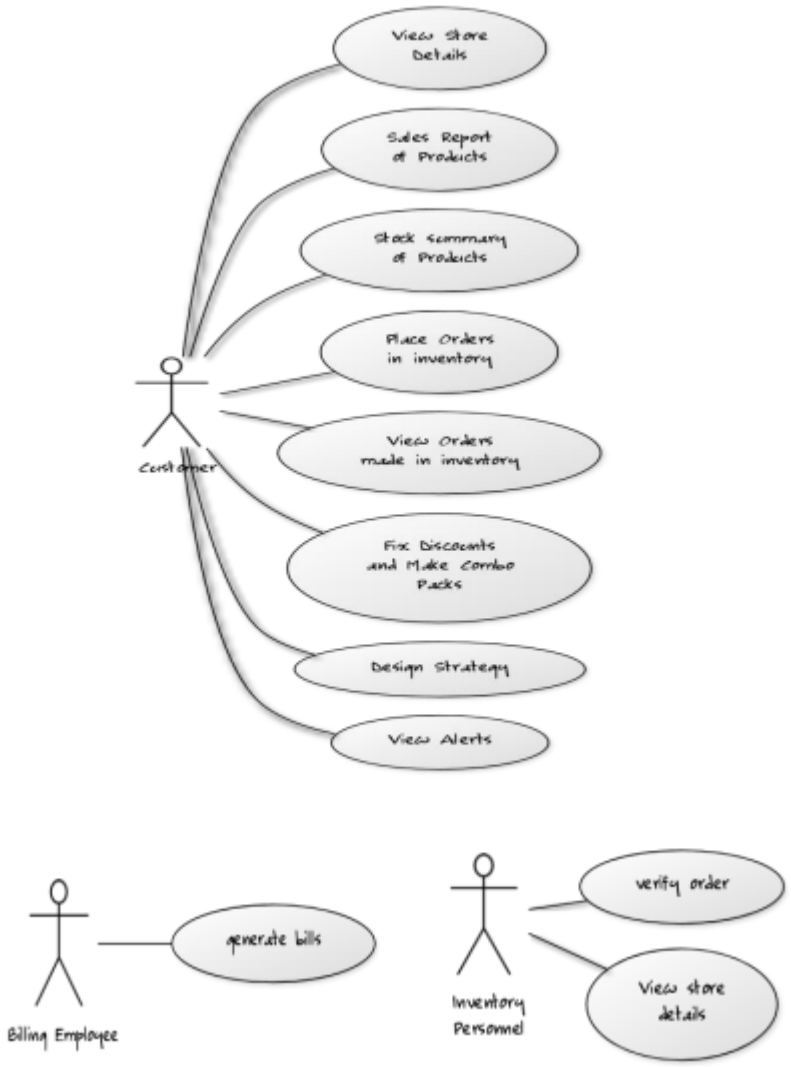
4.3.2. 1st Level DFD



5. ER Diagram (Expected)



6. Use Case diagram



7. Technology and Literature

7.1. Framework

7.1.1. .NET Framework

- The .NET framework is created and owned by Microsoft. It provides the addition to the large libraries and support for several programming languages and their interoperability. The program runs inside an application virtual machine and is executed by Common Language Runtime (CLR). CLR provides various services and along with the large library forms the .NET framework.

7.2. Languages and Tools

7.2.1. C#

- C# is an object oriented programming language developed by Microsoft that is based on C++, has similar features of Java and uses XML-based web-services. C# is designed to work with .NET framework of Microsoft. C# is intended to be a simple, modern, general-purpose, object-oriented programming language.

7.2.2. HTML

- Hyper Text Markup Language (HTML) is the main markup language for generating and displaying web pages and other media information inside a web browser. HTML is written using HTML tags enclosed in angle brackets. Between the starting and ending tags web designers can add any media type. Web browser interprets the HTML tags & content and then displays the Web Page.
- HTML allows all types of media (images, videos, audio), plain text (with structural semantics like paragraph, headings, links) and Scripts written in JavaScript.

7.2.3. JavaScript

- JavaScript is a programming language that makes the webpages look beautiful and innovative. JS is an interpreted programming language that means it doesn't need any other program to run. The main idea behind the development of JavaScript was to allow the client code to interact with user and alter the displayed content dynamically. Nowadays the improved versions of JavaScript have increased the popularity of server side script.

7.2.4. AJAX Toolkit

- ASP.NET AJAX is a set of extensions to ASP.NET to implement the functionality of Ajax. ASP.NET AJAX allows the developer to create web applications in ASP.NET 2.0 that can update data in the web page without reloading of the same. The key technology that enables this functionality is the object XMLHttpRequest, along with JavaScript and DHTML.

7.2.5. CSS

- Cascading Style Sheet (CSS) is used to design webpages and styling the content presented on the web pages. It enhances the User Interface and provides dynamic content handling (CSS3). The main feature of CSS is to present table less design and remove overhead of complex markup structures.

7.2.6. SQL

- SQL is a special-purpose programming language aimed for managing data that resides in a relational database management system (RDBMS).
- Originally based upon relational algebra and tuple relational calculus, SQL consists of a data definition language and a data manipulation language. It also includes procedural elements.

7.3. Networking

7.3.1. Communication and Remote Hosting

- A computer network is interconnection of multiple computer systems where the each computer, called as nodes, can communicate with each other and transfer data. The communication is accomplished with a combination of cables or wireless mediums and networking hardware. The best known example of network is internet.
- Communication protocols describe the rules and data formats for the data transfer. The popular communication protocols include Ethernet and Internet protocol suite (TCP/IP). Computer network supports services such as World Wide Web, file servers, email, instant messaging and printing.

7.3.2. Push technology

- Push, or server push, is a style of Internet-based communication where the central server or publisher initiates the request for the given transaction. The reverse of this is called Pull Technology.

7.3.3. Pull technology

- Pull coding or client pull is a network communication technique where the client triggers the initial request for data, which the server responds later. If implemented in reverse this technology would be called push technology, where the server pushes data to clients. Pull requests are at the base of network computing, where a centralised servers receives the data requests from multiple clients. Websites hits for searches using HTTP makes extensive usage of Pull Technology.

7.3.4. Threads

- A thread shows how the program executes in general. The programs written as Single thread may cause syntactical errors when multiple events happen to occur at the same time on the same resource.
- For example, the program cannot print values while it is taking input from the user. The most appropriate solution to this problem is to run two or multiple executions of the program at the same time. Threads allow implementing this solution.

7.4. Data Mining Techniques and Tools

7.4.1. WEKA

- Weka is a machine learning tool developed and presented by University of Waikato.
- It is java based software and can be either applied to Datasets or called from java code. It's an open source software under GNU public license which enables user to modify the patterns according to his need.
- The repository of WEKA provides large number of examples and data sets for classification, regression and clustering so that we can build our logic according and get better forecasting.

7.4.2. Apriori Algorithm

- The Apriori algorithm is widely used and influential algorithm to mine large datasets for Boolean association rules.
- It recognizes the frequent patterns and returns the next possible itemsets from the pool.
- With proper transaction handling and hashed based item counting, we can generate our own version of it and build the itemset for retail store.

7.4.3. Market Basket Analysis

- Market basket analysis is used to recognize frequent patterns and works on the probability of buying certain item on the basis what customer has bought just before.
- For Example, if you are a pizza store and order a pizza and don't buy breadsticks, you are more likely to buy cookies at the same time than nobody bought pizza.
- It returns more accurate results when combined to Apriori algorithm.
- In the current project, we will be using this to organize combos, discounts and sales patterns to achieve next target.

8. References

1. http://www.cs.waikato.ac.nz/ml/weka/
   - Official website of Weka. It provides a way to perform machine learning and data mining techniques. I has been developed by Machine Learning Group at the University of Waikato. The documentation and the interface provided by Weka inspired us to integrate it with .NET library.
2. http://money.howstuffworks.com/sales-forecasting.htm
   - This enabled us to dive more into sales forecasting and buyer-seller pattern. This has helped us to understand more about how selling data can create wonders. This website gives information about how general stuff works and how to get more profit from the finding general work around.
3. http://www.infoentrepreneurs.org/en/guides/forecast-and-plan-your-sales/
   - Info entrepreneurs is a leader in the delivery of quality strategic information on government programs and services directed to the business community. Info entrepreneurs constitute a privileged source of commercial information, thus contributing to the economic growth of business.
4. https://www.linkedin.com/pulse/20130607115409-12921524-how-did-we-get-here-a-short-history-of-retail
   - This described a whole story of how retailing dot into a picture and made it large. This actually gave us an idea of improving marketing and sales strategy of retailing. The blog is written by Josh Leibowitz, Chief Strategy Officer, Carnival Corporation.
5. http://goranxview.blogspot.com/2011/09/data-mining-in-retail-industry.html
   - This blog was all about data mining in retail industry. This actually helped us building financial data warehouse and data analysis in large selling patterns. The information shared here is very informative and spreads light on general mining strategies.
6. http://www.amazon.com/
   - Amazon is the leading e-commerce retailing company and uses data mining and big data techniques to improve their buyer selling patterns.
7. http://www.nytimes.com/2004/11/14/business/yourmoney/what-walmart-knows-about-customers-habits.html?_r=0
   - The idea of making such software which can actually predicts the future came into picture with this article. It gave us an insight of how data analysis can create magic if executed and maintained property.
8. http://www.walmartlabs.com/category/data-mining/
   - This is yet another interesting article which gave us an excitement when we read the whole stuff. The Walmart labs team did great research and created actual implementation.
9. http://www.encyclopedia.com/doc/1G2-3401200510.html
   - The story of how they started it and how it was implemented initially. The blog gives brief history of Walmart and data mining.
10. http://www.albionresearch.com/data_mining/market_basket.php
    - The market basket analysis and future scope of the technique. Helpful in the retailing industry and make useful implications.
11. https://www.wikipedia.org/
    - Source of everything and better researching tool. We have used many articles to improve our research. It was very helpful in determining most of the areas of the project.