CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM (CRMS) TO TRACE ASSOCIATION BETWEEN PRODUCTS

By

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Dissertation submitted in partial fulfilment of
The requirements for the
Bachelor of Technology (Hons)
(Business Information System)

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CERTIFICATION OF APPROVAL

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Business Information System Programme
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Approved by,

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TRONOH, PERAK
September 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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AISYAH NAEMAH BINTI MUSTAFAR

ABSTRACT

With a research-minded and end-user point of view and with the bibliographic overview, the project discuss on developing a Customer Relationship Management System (CRMS) to trace association between products. Mainly, the purpose of performing this project is to identify the relationship between products in the new environment situation, to design and develop Customer Relationship Management System (CRMS) towards the organization and to implement and test the prototype in the organization which is Rahmath's grocery shop. The aim of developing the system is due to the problems of new environment situation that lead to different social, demographic, geographic and behaviour of customers in purchasing a product and competition between existing and new companies in town that lead to customer tendency to change their typical place to purchase daily consumption. The new environment is influence by the opening of huge supermarket Tesco at Taman Maju. Taman Maju is the area which the scope of study in this project is conducted. Rahmath grocery shop is the organization that is targeted to implement the CRMS. The chosen of this scope is because Rahmath grocery shop is considered the existing shop in Taman Maju which obtains a new competitor (Tesco) that changes the current environment. Methodology used throughout this project is agile methodology that is based on incremental and repetition of development. The interaction between developer and users is consistent throughout the lifecycle of project. It is identify that CRMS could assist business in gaining customer retention and increase the business performance.

ACKNOWLEDGEMENT

First and foremost, I would like to thank the Almighty God for giving me the strength and wisdom to complete my project. Along this accomplishment of this project, there are many people that contribute and assist me in this development of project. It is my pleasure to acknowledge with gratitude the insights and excellent contributions by all the people involved.

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I would also like to acknowledge Pn Ros Hayati Binti Yaakob, clerk of Rahmath grocery shop, for sharing the information and feedback of the idea in implementing this system towards the business. In addition I would like to thank my beloved friends, Miss Azry Syafiqah Mohd Nasir and Miss Atika Abdul in facilitating and give full support in order to accomplish this final year project (FYP).

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ABBREVIATIONS AND NOMENCLATURES

CRM	Customer Relationship Management
CRMS	Customer Relationship Management System
DM	Data Mining
FYP	Final Year Project
UAT	User Acceptance Test
UML	Unified Modelling Language

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Customer Relationship Management (CRM) is a business strategy in order to understand, anticipate and respond to the needs of the business and potential customers conducive to grow and strengthen the relationship value. It is also an information industry term for software, methodologies, and usually internet capabilities that help company to manage customer relationship in an organized way. This business strategy assists the management, salespeople, and sales manager to access information on their customers and directly could increase the relationship value.

Basically CRM system help a company to enable its marketing department to identify and target their best customers, manage marketing campaigns and generate quality leads for the sales team. Sales and marketing team usually works as a team because the information gathered is used by both parties. Customers behaviour can be seen by their purchased of product and respond to any promotion given. Other than business aspect CRM also is viewed as a technology oriented. Advance in database technologies are crucial to the functionality and effectives of CRM system. CRM system in a company holds valuable customer information in a database.

CRM also is integrated with sales and technology that could give some impact such as improves targeting ability, enhance presentation skills, and increase business performance. CRM aid in improves targeting ability such as sorting

customer list, analyzing purchase pattern, identifying customer needs, and classifying customers. Nevertheless CRM s not only considers relationship of the company and the customer but CRM also is the relationship among the employees. That is why CRM could increase salesperson or manager in presentation skills. It would provide a better view of the company's customer. Moreover once the customer is identified it will ease the decision making in order to increase the business performance. Advance in technology enable manager to stay informed and communicate with salesperson and to be involve in decision making process. Decision making is facilitated by technology because large amount of information about business transaction can be stored and retrieved quickly.

Therefore CRM system allows company to optimize the information from the database to achieve customer retention and to cross-sell new products and services to existing customers. As said by many sales people, to catch a new customer is much harder than to preserve the existing customer. The success of implementing CRM is better relationship with customers; obtain loyalty from customers and increase revenue and sales. Critical analysis and understanding from customer's information is crucial because it determined the strategy that is going to be planned.

The content of this report will be in details about the Customer Relationship Management System to trace association between products. The case study and reference for this project is Rahmath groceries shop at Taman Maju,Tronoh Perak. Rahmath Taman Maju is chosen because of the arrival of new competitor in town which is Tesco to launch in Taman Maju. Impact from the new competitor to Rahmath, the behaviour of customer's purchasing of products is changing according to the new environment. This CRMS project assists in identifying association between products that is affected by the behaviour of customer's purchases. Furthermore this CRMS project to be implemented focus on groceries store or shop.

Rahmath is one of the grocery shops at Taman Maju. There is also few local grocery shop around Tronoh but it is not consider a big company as Tesco.

Usually local grocery shop does not implement CRM and does not have any CRM system in managing their business. Most local groceries shop focal point is towards the supplier and the stock of product. The sales of product for a certain area are different. For example, groceries shop near institution or school the product that is mostly bought is stationary, while groceries shop near housing area the product that is mostly bought is household product. Besides that the number of customer also depends on the certain duration of time such as festive season, school holiday and public holiday. Generally owner of the grocery shop would just identify their customer by observation. There is no system that could assist the owner in managing their Customer Relationship Management in the business.

As we know that Tesco is consider a large company and it takes a good strategy for a local grocery shop to beat them and be the one in customer's heart. Local grocery shop is still needed by any food based business such as restaurant, institution cafeteria, and many more. Mostly this type of customer bought all the raw material at the local grocery shop because the price is much cheaper and they already used towards the specific grocery shop. They could also buy in credit compare to Tesco they should buy the raw material in cash. Mainly this project is applicable to used in any supermarket based company.

1.2 PROBLEM STATEMENT

Customer Relationship Management system is widely implemented by many companies. This project helps to identify the obstacles to trace association between products. Below are the obstacles:

- **New environment lead to different social, demographic, geographic, and behaviour of customer's purchasing products.**

  As Tesco is newly launched in Taman Maju, it change the environment that course changes of social, demographic, and behaviour of customer's purchasing products. Tesco offer more variety of products that enhance the choices of customer toward a certain product to purchase. Moreover the size of building of Tesco is much bigger compare to Rahmath. It is suitable and convincing for any type of family size. This is because Tesco could afford to fit in a large amount of customer at a time.

- **Competition between existing companies and new companies in town lead to customer tendency to change their typical place to purchase product.**

  As stated above Tesco is newly launched at Taman Maju and give a huge impact to all the local groceries shop. At the early opening days of Tesco the number of customer in grocery shop at Taman Maju drop by 30%. The percentage is identified by the observation of the grocery shop. Customer is egger to experience the new company in town which is well known, Tesco. There are also many other shop inside Tesco that attract the customer to change their daily purchases from local grocery shop to Tesco. If the customer is continuously decreasing, it is a major concern for the grocery shop for this project which is Rahmath groceries shop at Taman Maju.

1.3 OBJECTIVES

There are three identified main objectives for this study/ project, which are described as below.

- To identify the relationship between products in the new environment situation.
- To design and develop Customer Relationship Management System towards the organization.
- To test the prototype in the organization (Rahmath's groceries shop).

1.4 SCOPE OF STUDY

As for the scope of study, it has been clearly stated in the project background the system is acquire Rahmath groceries shop at Taman Maju as the case study. The reasons of limiting this scope of study are due to these reasons:

- Rahmath groceries shop is considered the existing shop in Taman Maju which obtains a new competitor (Tesco) that changes the current environment situation.
- Time given to complete the research report and the system is less than one year. Due to the time constraint, the study has to be conducted within UTP area, which Taman Maju is the nearest.

1.5 RELEVENCY OF THE PROJECT

This system is relevant to the need of the organization. As discuss above, most grocery shop does not implement CRM system, usually the small business grocery shop. This project helps the users in identifying the association between products based on the record of customer's purchases. Moreover, CRM system that is exists in the market comprises of lost of features and complexity. This project is mainly focus on knowing the association between products and suggesting decision strategy based on the result.

The suggested decision strategies are layout strategy, promotion of product, and loyalty program. In order to elaborate more, the **layout strategy** is mainly proposed that the both items which is associated together to be placed near to each other. The relevant of this strategy is because, the time taken for the customer to reach from one item to the other item can be reduce by placing it near to each other. This will ease the customer in organizing their movement in the shop while shopping for more items. Moreover, not all customers meant to have a leisure time while buying their daily product in a grocery shop. Some of them only want to buy the thing that is already in their shopping list and do not have much time for searching the items in the store. By having an organized layout strategy of products in the shop it will affect on the customer retention towards the business.

On the other hand, the second strategy is promotion of product. **Promotion of products** is to offer a promotion to the customer when they purchase the items that are associated together. The promotion is when the customer purchases two of item A, then they will get discount of item B. Through this strategy, the owner can set which item that return high profit margin compare to the other item, hence the item would be the one that is offer to buy more than one. As a result the business can gain

the opportunities of gaining more profit from the most frequent item purchase at the grocery shop.

Last but not least, the third strategy which is the loyalty program. **Loyalty program** refer to the customer that is already register as a membership. The function of membership is to collect point that the customer can retrieve benefit from it. Customers these days can be consider as intellectual, because they are willing to purchase at the certain shop while expecting to retrieve benefit from the shop as well. That is the reason why many businesses recently offer membership to the customer in order to attract and gain the loyalty from the customer. Some of the benefit is retrieve gift during the customer's birthday, discount on a specific of product and many more. Therefore, CRMS offers the loyalty strategy in term of redeem point. If the customers purchase the specific item, they will get 10 point to be accumulated in the current point they have. That is the reason why those three strategies are suggested towards the business.

In addition, the population of Tronoh is increasing and there would be more business activity that involved the customer and the organization. The implementation of this project helps the organization in capture all those opportunities and gain benefit from it. The record or customer's purchases are store in the database for further analysis and references.

1.6 PROJECT FEASIBILITY WITHIN THE SCOPE AND TIME FRAME

Project feasibility is an evaluation and analysis of this proposed project to determine if it is technically feasible, is it feasible within estimated cost, and time and it is

profitable. Within this extended proposal only two feasibility are analyze; operational feasibility and technical feasibility.

Operational Feasibility

Operational feasibility mainly concern whether the system will be useful to company if it is developed and implemented. It is also concern that the user in using this system is able to adapt and fully utilized the system in the company's business activity. This system's architecture for this project is straightforward and user is able to cope and understand the functionality. User that is using this system is the salesperson, sale manager, marketing manager and the management of the company.

Technical Feasibility

Technical feasibility is concern with the technology and resources to develop the specific system. Mainly the technology used to complete this project is by using Microsoft visual basic and MySQL. Microsoft visual basic is meant for the user interface of the system, while MySQL is meant for the database to store the data. Below are the process flows for as-is system, which is usually used in huge supermarket and to-be system, to be implemented in the grocery shop.

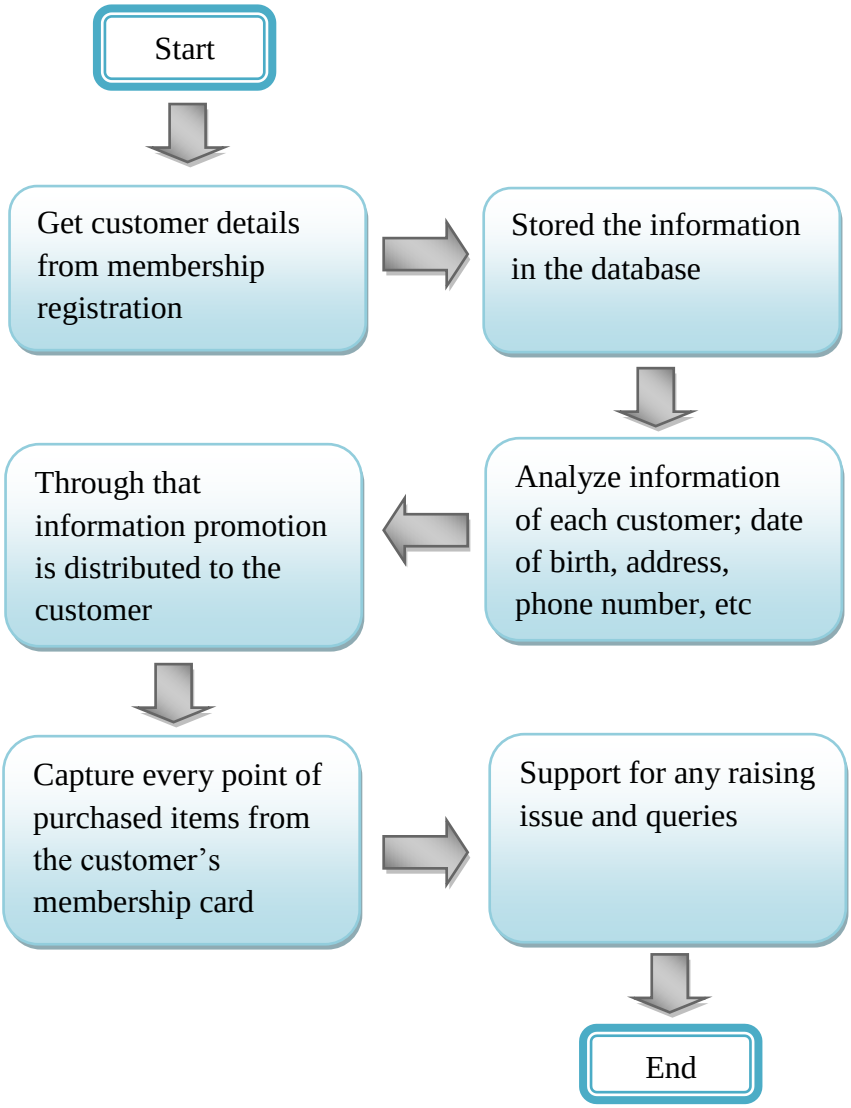

Figure 1 As-Is Process Flow

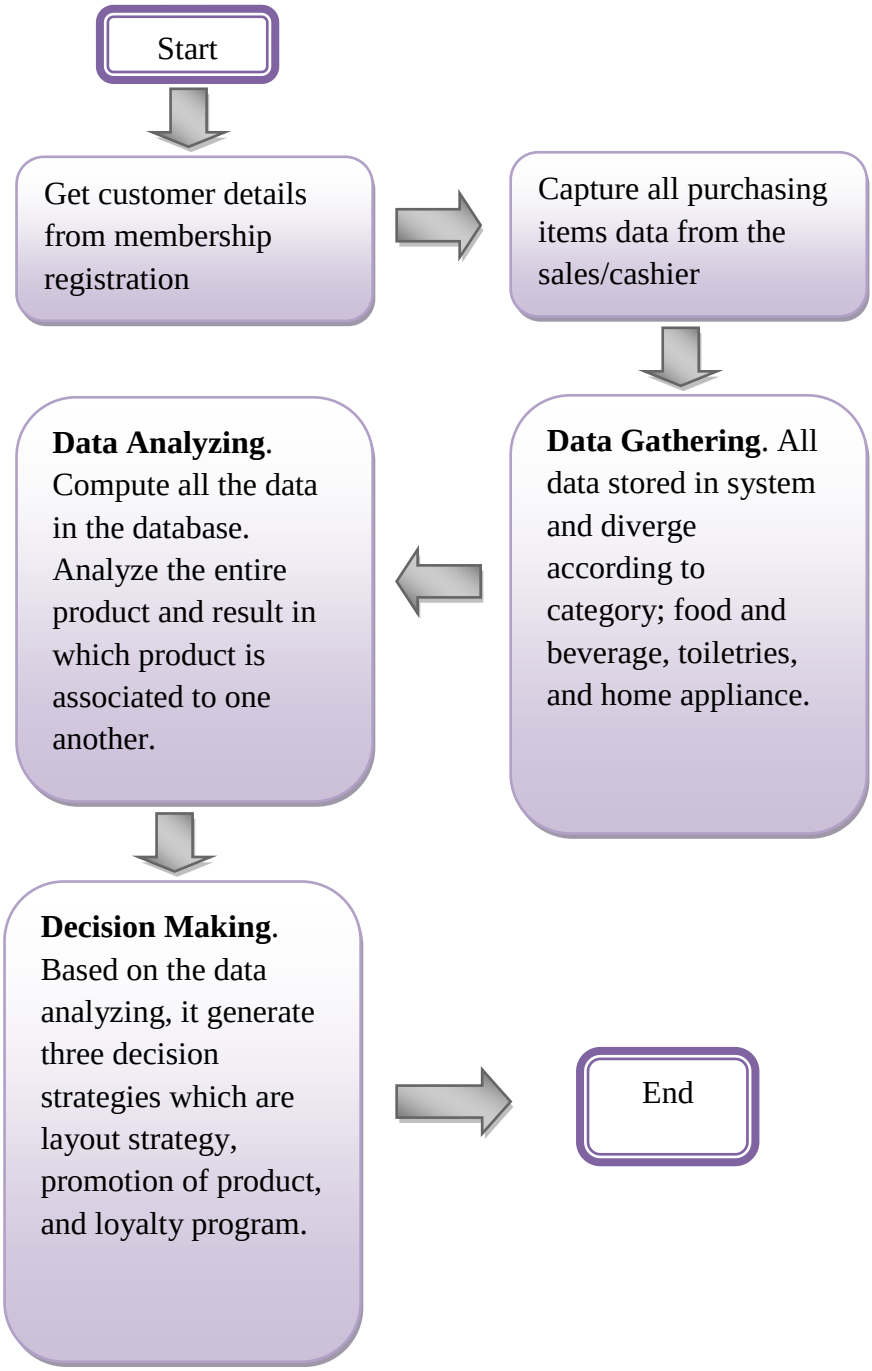

Figure 2 To-be Process Flow

CHAPTER 2

LITERATURE REVIEW

2.1 LITERATURE REVIEW

The relationship with customer is key to competitive success in consumer markets. Customer Relationship Management is about developing a better understanding of customer, predicting with excellent accuracy customer's needs, and directly all functional resources to address these needs with customized and personalized products and services (Gandossy, Tucker & Verma,2006). Gandossy, Tucker & Verma (2006) also state that CRM helps different organizations increase the value of existing customer bases, strengthen competitive advantages, and enhance customer satisfaction.

Based on the statement, customer relationship management help company to gather customer information and able to analyze the pattern. To have a better analyzing of information normally company would have CRM system to gather all the data in an organized way. CRM is a combination of business processes and technology that meant to understand a company's customers from multiple aspects to differentiate a company's product and services among competitors. It uses IT to integrate sales, marketing, product and services to gain customer loyalty and increase business profit. CRM generally improve customer identification, acquisition and retention (Tiwana, 2001).

Kim et al.(2003) define CRM in terms of business process and technologies that seek to understand a company's customer. Kim shares the same point of view as Tiwana. This shows how this project is relevant with the combination of CRM and technology. Winer (2001) considers the basic element in CRM to be is a database of customer activity, analysis of the data in the database to support customer preferable criteria of a product, tools for targeting the selected customers and metrics for measuring the success of the CRM program. Based on this project, database of customer activity is retrieve according to their purchase of product and it is gathered to be analyzed.

On the other hand, data mining (DM) is the technology that allows searching through large amount of data for meaningful patterns of customers' behaviour such as switching behaviours, fraud patterns, market basket analysis, and customer trends. In this project, the market basket analysis is only the element to be focus in the decision making part. Market basket analysis is a DM application in retailing business that is using an item-to-items collaborative filtering technique. This technique determines which products customers are likely to purchase together in a shopping cart. Once the retailer knows that customers who buy one product are likely to buy others, it can recommend other products.

In this project the market basket analysis is implemented in the CRM system. Market basket analysis is one of the most common and useful types of data analysis for marketing. It is an algorithm that examines a long list of transaction in order to determine which items are most frequently purchased together. The purpose of this analysis is to determine what products customers purchase together. Knowing what products people purchases as a group, can be very helpful to the business. The company could use this information to place products frequently sold together into

the same area. Furthermore, direct marketers could use the market basket analysis to determine what new product to offer to their prior customers.

Based on Berson et al, (2000), data mining tools are a well-liked means of analyzing customer data within the analytical CRM framework. The CRM framework can be classified into operation which is refer to the automation of business process, whereas analytical refer to the analysis of customer characteristic and behaviour. Basically, many organizations have collected and stored a huge of data about their current customers, potential customers, suppliers and business partners. Despite of that, the inability to discover valuable information hidden in the data prevents the organization from transforming these data into valuable and useful knowledge. Turban, Aronson, Liang and Sharda(2007) defines data mining as "the process that uses statistical, mathematic, artificial intelligent and machine-learning techniques to extract and identify useful information and subsequently gain knowledge from large database".

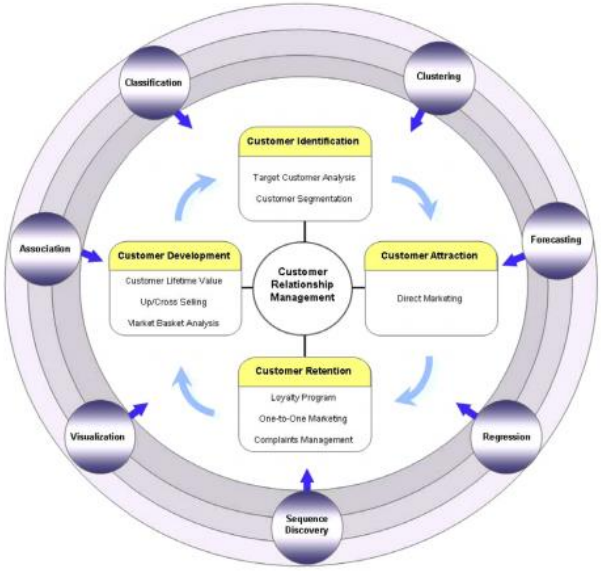

Figure 3 Classification frameworks for data mining techniques in CRM

This framework is based on research conducted by Swift (2001), Parvatiyar and Sheth(2001) and Kracklauer et al.(2004). They describe CRM dimensions as: Customer Identification, Customer Attraction, Customer Retention and Customer Development. Furthermore, Ahmed (2004), Carrier and Povel (2003), Mitra et al.(2002), Shaw et.al(2001) describe the type of data model which are; Association, Classification, Clustering, Forecasting, Regression, Sequence Discovery and Visualization.

CHAPTER 3

METHODOLOGY

3.1 RESEARCH METHODOLOGY

Agile methodology is a system methodology that is based on incremental and repetition of development. It presents adaptive planning, designing, development, and deployment. Furthermore this methodology encourages rapid and flexible respond to change. This is because the interaction between the users is consistent throughout the lifecycle of project. Crucial element of agile methodology is adaptive side. Adaptive method applies to adapting quickly to changing realities.

Sometimes user's requirement keep on changing until they are satisfied and achieve the purpose of having the system. Developer should be alert and reliable for user to interact and confer about the requirement. The chosen of this system methodology is related to the scope of study in this project which is Rahmath grocery shop at Taman Maju. Taman Maju is near to Universiti Teknologi Petronas (UTP), so it will ease and expedite the interaction among the user and developer. Is there is any new requirement or changes in the system architecture, the developer can quickly clarify it with the user.

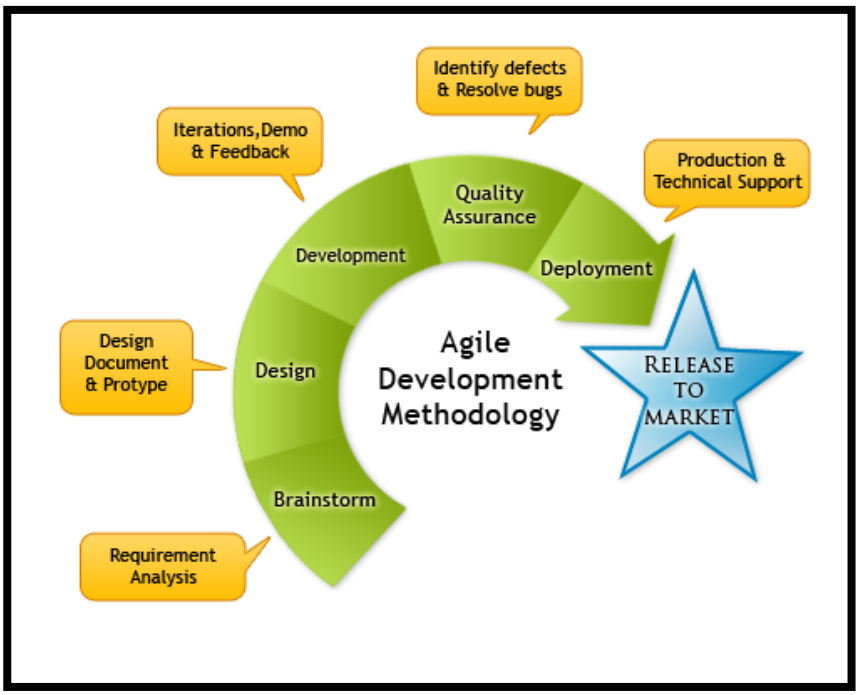

Figure 4 Agile Development Methodology

3.2 PROJECT ACTIVITIES

In this project some project activities are conducted along the system development period:

1) Define research problem

For this project, the problem has been identified where there is a need in identifying the association between products. This is cause by the new competitor that led to the changes in the environment. Because of this, Customer Relationship Management System to trace association between products is to be developed in order to resolve the problem. Furthermore, this project helps the business in suggesting three decision strategies which are layout strategy, promotion of product and loyalty program. This project is mainly to be implemented in grocery store or shop.

2) Review concept and theories

In the literature review, critical analysis is conducted in order to have a better understanding on the research area and to review for any existing system in the market. Throughout the research this project is implementing market basket analysis which using the apriori algorithm. This algorithm is mainly to generate the analysis of the association between products. Further benefit of this method is discussed in the literature review.

3) Gathering project requirements/Data gathering

Data and information gathered on the user requirement is using different method of data collection such as survey, interview and observation. The requirement from the user specific the function to be in the system once it is developed. In this project data gathering is by two methods which are sampling method and data collection. Sampling method is concerned with the selection of individuals from a population to estimate the character of the whole population. While Data collection method is process of preparing and collecting data by interviewing the specific target. In order to gain more information conducting an interview with the salesperson or sale manager is a recommended approach. The results of both methods are included in the result and discussion section.

Table 1 Data Gathering and Analysis

Data gathering and analysis	Data Collection	Sampling method
How?	Interview and observation	Survey through questionnaire
Where?	Rahmath Groceries Shop at Taman Maju	Population around Taman Maju
Whom?	Owner or sales manager	Individual around age 13 years old and above
Medium of distribution?	Face to face interview	Email and direct distribution
Scope of data gathered?	-Information about previous system. -Introduce the system and gain feedback	-The specific shop they purchase daily product. -Frequency of purchasing product at that shop

4) System Design

System design emphasizes on how the system should function in order to fulfil the requirement. This includes the architecture design, framework design, database design, and user interface design. In addition the Unified Modelling Language (UML) modelling, such as Use Case Diagrams.

5) Development/Implementation

This phase is the process of developing the system according to the specific requirements. The tools for developing the system has been decided in order to execute and built the system. The implementation phase deals with issues of quality, components and debugging.

6) Testing

System testing is the important phase of the lifecycle development. System testing of software is implemented to a complete and integrated system to evaluate the system's features with the specific requirement. For this project two testing is going to held which are unit testing (Unit Test) and User Acceptance Test (UAT).

Unit Test is producing test to ensure that the complete system has the correct behavior and requirement. Usually Unit Test is tested by the developer itself. User Acceptance Test is to also test that the complete system meet the requirement of user. The user usually does this type of testing on the complete system. Once the user is satisfied the complete system is consider a success.

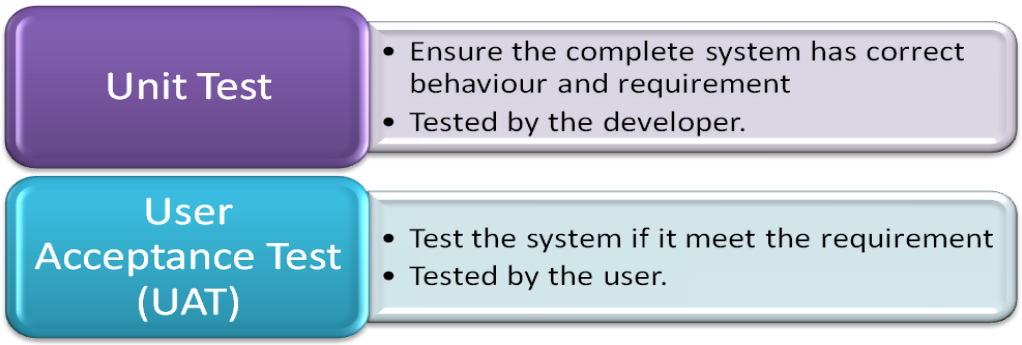

Figure 5 Type of Testing

7) System Deployment

System deployment is the final phase that involves the full system to be deployed and function according to the requirement.

3.3 KEY MILESTONE

There are five phases in completing the FYP 1 and FYP 2. Each of the tasks needs to be complete and submit to the according person.

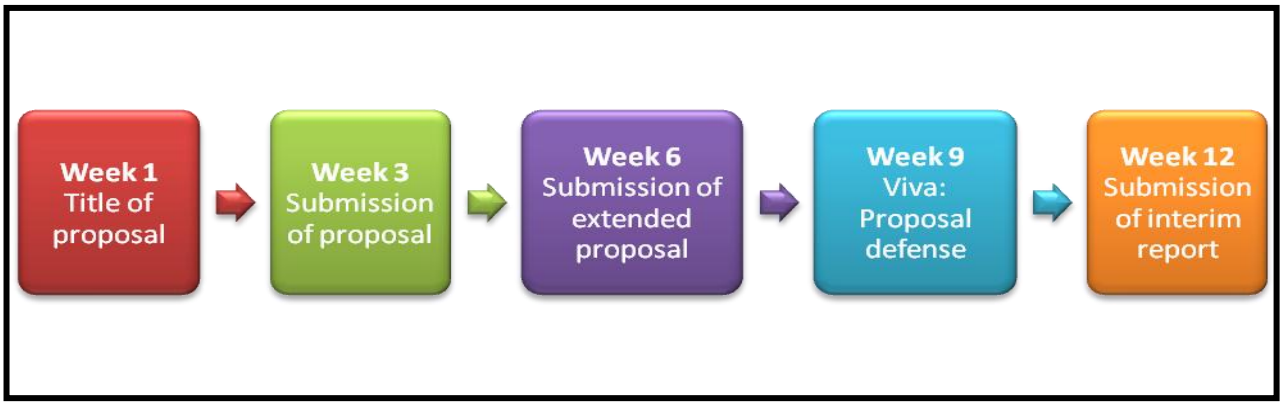

Figure 6 Key Milestones for FYP1

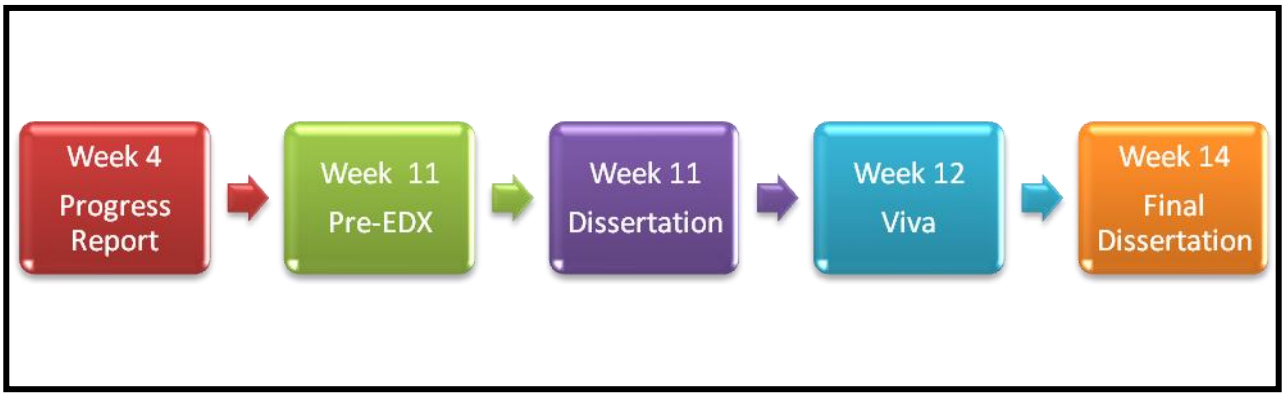

Figure 7 Key Milestones for FYP2

3.4 GANT CHART

Table 2 Gant Chart FYP 1

		FYP 1 : WEEKS (January2012 - May 2012)													
NO	PROCEDURE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Title of selection /proposal	◆													
2	Preliminary Research Work		■												
3	Submission of Proposal			◆											
4	Research and Planning Phase				■	■									
5	Submisssion of Extended Proposal						◆								
6	Data Gathering and Analysis							■	■	■					
7	Viva: Proposal Defense and Progress Evaluation										◆				
8	Progress Work Continue										■	■	■		
9	Submission of interim report													◆	

Table 3 Gant Chart FYP 2

		FYP 2 (September 2012-January 2013)													
NO	PROCEDURE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Project work proceeds	■	■	■											
2	Initial development phase		■	■											
3	Submission of progress report				◆										
4	Continues of development phase				■	■	■								
5	Implementation						■	■							
6	Testing							■	■						
7	Pre-EDX								◆						
8	Further testing and improvement								■	■	■				
9	Submission of dissertation											◆			
10	Preparation for Viva and complete demonstartion											■	■		
11	Viva												◆		
12	Preparation of technical report												■	■	
13	Submission of technical report														◆

3.5 TOOLS TO DEVELOP SYSTEM

Software development tools that will be used during the software development are Microsoft Visual Studio 2005. This software is meant to develop the user interface of CRMS and it is the common software to use when developing system with VB.net. CRMS will be using MySQL database platform because it is more reliable to store more data which can support a large database. Furthermore, Adobe Photoshop CS2 is used to create the design and icon that is used in the user interface of CRMS. For the documentation which is the report is using Microsoft Office 2007.

Table 4 Tools to develop

Element	Software/Platform
Development Tool	Microsoft Visual Studio 2005
Database	MySQL.
Documentation	Microsoft Office 2007 (Word, Excel)
Design and icon	Adobe Photoshop

3.5.1 HARDWARE REQUIREMENT

In order to develop CRMS, the developer recommends the following hardware specification and requirement to support the system. As shown below is the hardware requirement for this project:

Table 5 Hardware Requirement

Hardware	Descriptions
Processor	Intel Core 2 Duo
Memory	At least 512MB or much higher (1 GB or higher)
Hard Disk	At least 1 GB

CHAPTER 4

RESULT AND DISCUSSION

This chapter will discuss the result and findings from the research methodology discuss in the previous chapter. Generally, it covers both the data collection and sampling method.

4.1 DATA GATHERING/DATA ANALYSIS

According to the result gathered from both data collection and sampling method, the feedback of implementing this project toward the business is positively accepted. The benefit is totally seen and identified by the owner of the grocery shop. CRMS is aim to help the business to further improve the business performance. Based on the result given by CRMS, which is the frequent items that is purchased by the customer, it helps to planned strategy that involved the customer as well as the suppliers. Furthermore, the owner can focus on selling the product which is most frequently bought that give high profit margin towards to the business.

Obtaining customer retention is the hardest part in any business, which is why most business invests a lot of money in marketing which include advertising the business. Moreover the record of sales is capture and store in the database which can be view for further reference and analysis.

4.1.1 The Framework System

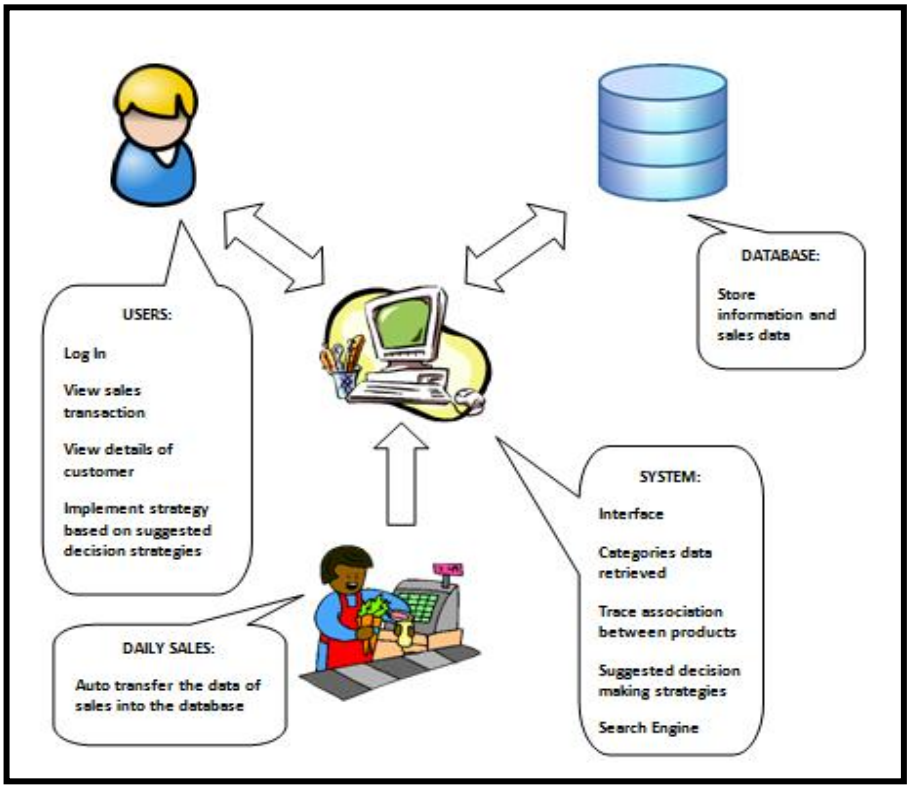

Figure 8 Frameworks of CRMS

The users here include:

- Owner or sales manager of the system who can:
    - Log in.
    - View all the categories data (toiletries, food and beverages, home appliance).
    - Built strategy based on suggested decision strategies (layout strategy, promotion on product, loyalty program).
    - View details of customer that is stored in the database.
- The system will include:
    - A user-friendly interface.

- A search engine to find the data (product) according to categories and searching the customer's details.
- A database: to store all the information about the sales and purchased product.

This system help to identify the association between products based on the customer's purchases. At the end of each day the sales of the company is computerize into the database. Each of the data is categories according to the type of product. The categories available are food and beverage, toiletries, and home appliance. Each category can be view in sales transaction according to the specific period desire.

Owner or sales manager is able to view the amount of purchased product based on categories. For security purpose this system would require user to log in into the system. There is no unique privilege of the user. This is because the user is the owner or sales manager and the privilege for all users are the same. This is also to prevent from outsider to be able to view the sales data and the automated decision strategy suggested implemented by the grocery shop. The automated strategy for decision making is based on data mining market basket analysis.

Market Basket Analysis is a process which analyzes the habits of the buyer to find a relationship between different items on their shopping cart (market basket). By discovering this relationship it can assist the owner or sales manager to develop a sales strategy to consider items frequently purchased together by customers. For example, if a customer buy flour, the potential of buying sugar is likely at the same transaction. The result of the analysis can be applied to sales planning such as items frequently purchased together are placed close together. Moreover, there are few

method in market basket analysis that is in order to execute the result. For this project the method which is implemented is Apriori algorithm is used in executing the result of the frequent items. To explain more about market basket analysis, some example is explained below:

Table 6 Data Set of Transaction

TID	*Items*
1	**Bread, Milk**
2	**Bread, Diaper, Beer, Eggs**
3	**Milk, Diaper, Beer, Coke**
4	**Bread, Milk, Diaper, Beer**
5	**Bread, Milk, Diaper, Coke**

As mention before the market basket analysis is discovering the relations between variables in a large database. It is also analyze the habit of buyer to find a relationship between different items on their shopping cart. There are few terms or variable that is used in order to perform the market basket analysis. The first part is frequent item set; the second part is the association rule. The frequent item set consist;

- Item Set
  - A collection of one or more items
  - Example based on the table 6 : {Milk, Bread, Diaper}
- Support count
  - Frequency of occurrence of an item set
  - Example based on table 6 : {Milk, Bread, Diaper} = 2
- Support
  - Fraction of transaction that contain an item set
  - Example based on table 6 : {Milk, Bread, Diaper} = 2/5
- Frequent Item set
  - An item set whose support is greater than or equal to the minimum support required.

While the association rule consists of;

- Association rule
  - An implication expression of the form $X \longrightarrow Y$, where X and Y are item set
  - Example: {Milk $\longrightarrow$ Diaper}
- Rule Evaluation Metrics
  - Support (s)
    - Fraction of transaction that contains both X and Y
    - $\frac{n(X \cap Y)}{N}$
  - Confident (c)
    - Measure how often items in Y appear in transactions that contain X
    - $\frac{n(X \cap Y)}{n(X)}$

Given a set of transaction (table), the goal of association rule is to find all rules having

- Support > minimum support required
- Confident > minimum support required

Based on the transaction above(table 6), the **minimum support required is 60%**, while the **minimum confident required is 80%**. The number of frequent item set should appear in order to meet the minimum support is at least 3 times. The calculation is 60% * 5(number of transaction) = 3 times.
Then the single combination of product is analyzed:

Single product, Combination 1

Item	Frequent Item set
Bread	4
Milk	4
Diaper	4
Beer	3
~~Egg~~	~~1~~
~~Coke~~	~~1~~

Coke and Egg are canceled out because the frequent item set does not reach the minimum support required which are 3. The second combination is between two products. The two products are based on the possibilities of two products purchase together.

Two products, Combination 2

Item	Frequent Item set
Bread → Milk	3
Bread → Diaper	3
~~Bread → Beer~~	~~2~~
Milk → Diaper	3
~~Milk → Beer~~	~~2~~
Diaper → Beer	3

Therefore the combination between {Bread, Beer} and {Milk, Beer} does not occur in this item set because it does not meet the minimum support. The third combination is between three products.

Three products, Combination 3

Item	Frequent Item set
~~Bread, Milk ► Diaper~~	~~2~~
~~Bread, Diaper ► Beer~~	~~1~~
~~Milk, Diaper ► Beer~~	~~2~~
~~Diaper, Beer ► Bread~~	~~2~~

As shown above, there is not possible combination of three products based on the item set. As a result the two products in combination two is been calculated the support and confident to know which product is associate to another.

Table 7 Result of the Association Rule

Association between products	Support (%)	Confident (%)
Bread⟶ Milk	3 / 5 = 60	3 / 4 = 75
Bread⟶ Diaper	3 / 5 = 60	3 / 4 = 75
Milk⟶ Diaper	3 / 5 = 60	3 / 4 = 75
Diaper⟶ Beer	3 / 5 = 60	3 / 4 = 75
Milk⟶ Bread	3 / 5 = 60	3 /4 = 75
Diaper⟶ Bread	3 / 5 = 60	3 /4 = 75
Diaper⟶ Milk	3 / 5 = 60	3 / 4 = 75
Beer⟶ Diaper	3 / 5 = 60	3 / 3 = 100

Based on the table 7, all the association between products meets the minimum support. However not all meet the minimum confident that is required. Only
Beer ⟶ Diaper meet the minimum confident required and also has the highest confident score among other association products. Hence, it can be conclude that Beer is associated with Diaper by 60% of support and 100% of confident. It can be said that customer will purchase beer as well as diaper in one transaction.

The database of this system would hold a massive amount of data. The capacity and compatibility of the database should be superior in order for the system to retrieve the data in a real time basis. This system is beneficial for owner that own local grocery shop that would help in increasing the business performance and for further long-term goal of the company. In any business, customer is crucial because without customer the operation of business is not functional.

4.1.2 System Architecture

Figure below show the system architecture of CRMS. There are three essential element of developing the project which is client, the system and the database. In the first part, client site it will be the user's computer or personal laptop and web browser where CRMS is a web-based system. The most applicable web-browser that is used for CRMS is Mozilla. In the system part, the system is a web-based system develops by using asp.net. While in the database site, it used MySQL in order to develop this project. The database act as the storage for all the data that is need to be captured.

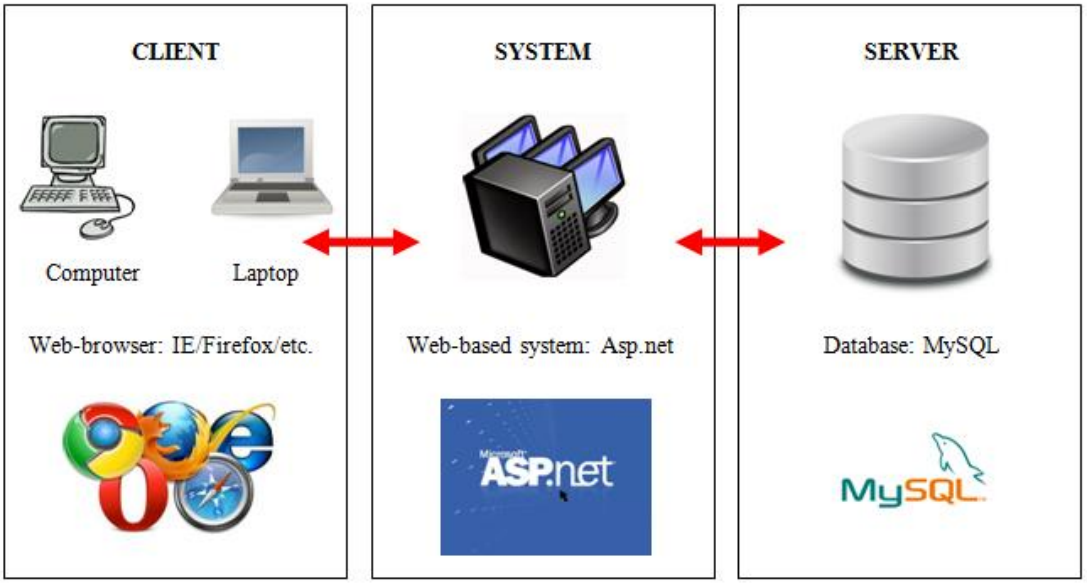

Figure 9 CRMS System Architecture

4.1.3 Unified Modelling Language (UML)

In the system development process, there are two different models that are significant which are the activity diagrams, and use case diagrams. Each of the diagram have different significant toward the project and enhances that understanding of a system development process.

4.1.3.1 Activity Diagrams of CRMS

Activity diagrams represent the functionalities of the system, the logic of an operation and the flow of the system. Below shows the activity diagram of CRMS:

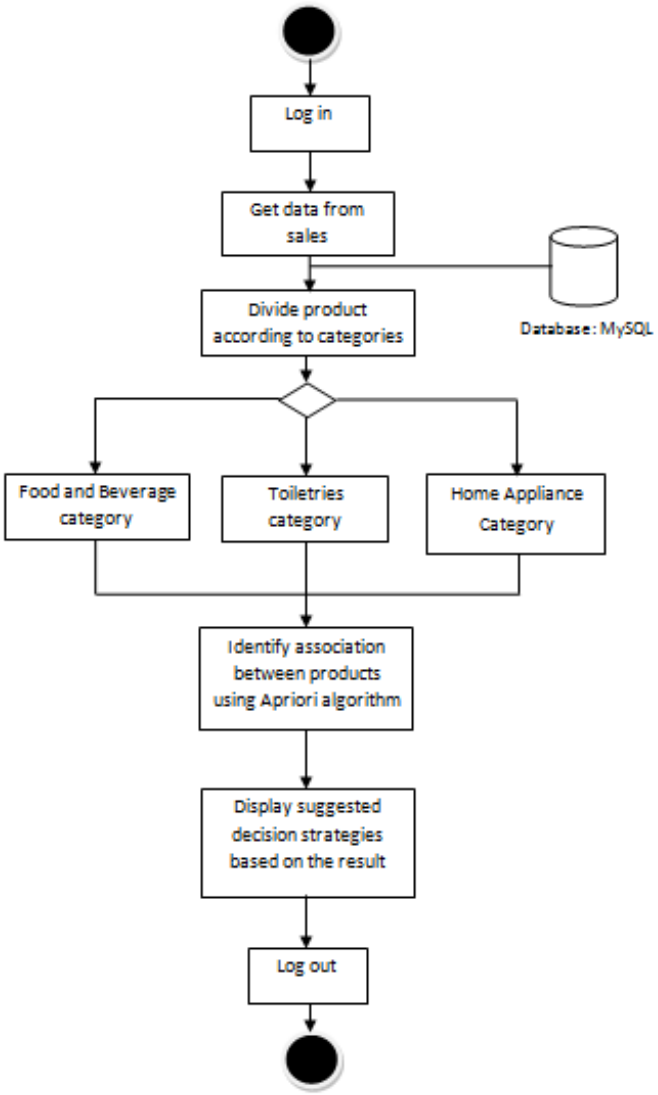

Figure 10 Activity diagram of CRMS

4.1.3.2 Use-Case Diagrams of CRMS

Use case diagrams, describes the functionality of the system from the user's point of view.

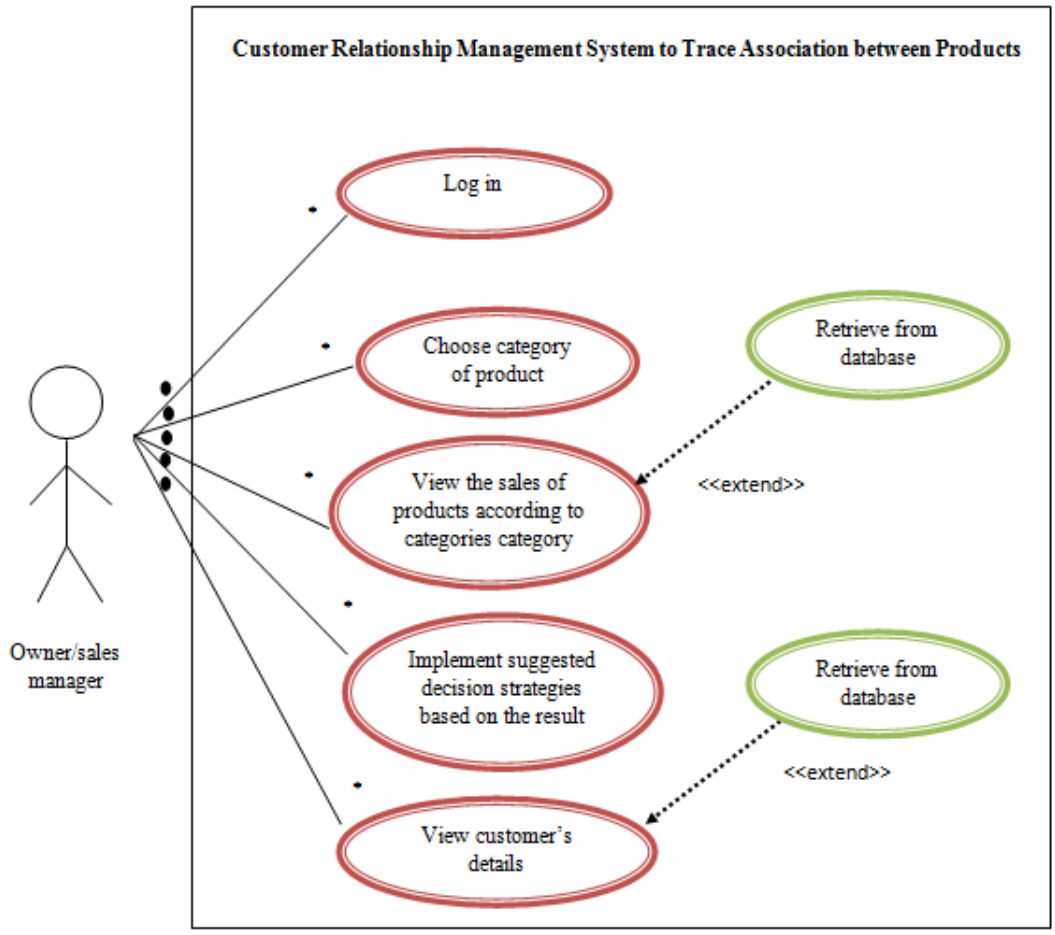

Figure 11 Use Case diagram of CRMS

4.2 FINDINGS

In this first part of this project the data of gathering analysis is done by two types which are data collection and sampling method. Both of the data is gathered in different time frame. Before data collection is gathered, sampling method is carry out to identify the feedback of the community towards a certain factor that influence the idea of developing this system.

Sampling Method

This survey was carried out using a set of questionnaire that serves the purpose of identifying the respond towards the opening of Tesco at Taman Maju, Perak. The target respondents are community around age 13 years and above at Taman Maju because this project scope of study is at Rahmath grocery shop at Taman Maju. The sample size of the questionnaires being distributed are 30 respondents.

The type of question is construct based on the problem statement discover in this project. It is known that most of the communities in Taman Maju purchase their daily product at Rahmath grocery shop because before this there are few supermarkets in town. Taman Maju is towns that can be consider low rapid development. Therefore the community bought daily product at local grocery shop.

When Tesco come in town, 60% of the populations of Taman Maju switch their purchase of daily product from Rahmath grocery shop to Tesco. While 40% still remain buying product at Rahmath.

The 40% population of Rahmath's customers is people that own a restaurant or cafeteria at certain institute and customer. This is because they are used to purchase the raw material or product in bulk at Rahmath which also offer purchase in credit.

From those 60% of people that switch to Tesco it is asked the reason why they change and respond toward the new Tesco in Taman Maju. The reasons are as below:

Table 8 Reason customers go to Tesco

Scope of reason	Reason
More choices	Brand of product
	Sell more products. Eg: Cloth, home appliance, electric appliance, etc.
	Comparison of price
	Buy product in large quantity
Condition of Tesco's shop	More conducive and convenience
	Offer other attractive shop. E.g.: cool blog, arcade, computer appliance, etc.
Product arrangement	More systematic and organized
	The price label is stated.

All the reason from the responded is scope into three categories that are more choices, conditions of Tesco's shop and product arrangement. Customers prefer to have more choices of brand for a certain product. The brand of product depends on the individual's preference. Furthermore Tesco also offer more products to customer such as cloth, home appliance, electronic appliance and

many more. There is many type of cloth; pyjamas, t-shirt, trousers, sport attire and others. Customers don't need to go to Ipoh in order to buy a cloth that can be bought at Taman Maju. This would save the cost and also time consume for the customer to go to Ipoh. Some of the product is much cheaper than Rahmath grocery shop by cents or RM1.

The structure and building of Tesco is huge than other local grocery shop at Taman Maju. It is more conducive and convenience for a bunch of family to go and shopping at Tesco. Due to this customer is more likely to spend more time inside Tesco and has the potential of purchasing more. The parking space that Tesco provide also can fit in a lot of car at a time. This will ease the customer and they do not have to worry about parking space. Furthermore there are also other attractive shop inside Tesco, such as cool blog, arcade, computer appliance and many more. From a few responded they state that sometime they only go to Tesco to buy cool blog. By the way, cool blog is a smoothies shop that offer variety flavour of smoothies that most youngsters like.

Moreover the product arrangement of product is more systematic and organized. The product is arranged according to section and it is related among each product. For example all toiletries such as soap, powder, tooth paste, shampoo and others is gathered together in the same section. There are also signboards that indicate that which section belong to which product to ease the searching of a product. At times the price of a product is not stated and it could

irritate the customer and eventually the customer is not satisfied and pleased about it. This matter does not usually happen at Tesco because all the price of product is stated. Below is the figure that illustrates the changes of customer from Rahmat to Tesco.

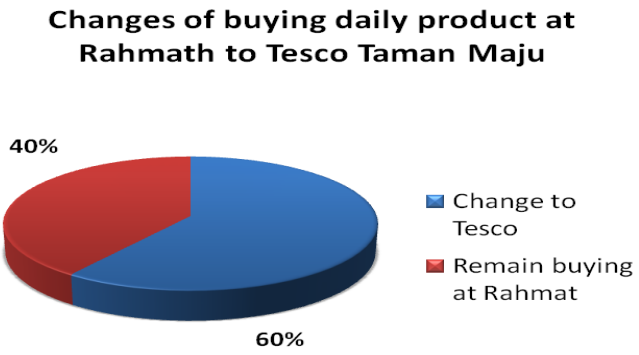

Figure 12 Pie charts illustrating the changes of buying product

Date Collection

Interview and Observation

Interview is the most common and direct method to gather information. The type of interview conducted is semi-conducted interview in which it combines pre-determined sets of open questions. The interview is conducted via face-to-face conversation with the clerk of Rahmath grocery shop. This is due to the owner of the shop is not available and assign the clerk to be in the interview session on behalf of him. In order to have a solid data gathering, owner of another local grocery shop is interviewed which is Halida grocery shop. Both of the respondents have the same content in

sharing their knowledge and information. Below is the interview summary with the respondent:

Person Interviewed:

- Pn Ros Hayati Binti Yaakob, clerk of Rahmath grocery shop, Taman Maju, Tronoh Perak.
- Pn Halida Binti Ahmad, owner of Halida grocery shop, Taman Maju, Tronoh Perak.

Interviewer: Aisyah Naemah Bt Mustafar

Purpose*:* To obtain the feedback about the usage of customer relationship management in the business and also the relevant of the project to be implemented in the business.

Summary of Interview:

Most local grocery shop does not implement CRM system in the business. They are more focus toward the supplier of product to make sure that the product is not out of stock. It does not also keep the record of customer's purchases but only the record of invoice and stock of product. They also mention about the promotion given by the supplier if the product is bought in bulk. In certain amount of bulk the supplier will give free of charge of product for a certain quantity.

The regular customers of the local grocery shop are customers that own a restaurant, cafeteria in an institute or other based business that require a massive purchase of raw material. The price of product at local grocery shop is less expensive than Tesco for a certain product. Especially for raw

material that is the reason most of the customer is as stated before. The owner does evaluate the customer's behavior of purchases but not using a develop system. It is done by observation and stock of product.

Through observation the numbers of customer reduce when university student is having their semester break. This is because Rahmath grocery shop is located in between of Universiti Teknologi Petronas (UTP) and UiTM Seri Iskandar. There are also few institutes around Taman Maju and Seri Iskandar. Hence the majority of customers consist of student that is likely looking for a much cheaper grocery shop to buy things.

The major purpose of this interview is to know the feedback and affect to their business when Tesco is open at Taman Maju. For a few month of the opening of Tesco it can be seen that most of the customer go to Tesco and the number of customer at Rahmath and other local grocery shop is reducing. This is because people are eager to go to a new supermarket in town which offers more things than local grocery shop.

Rahmath grocery shop is interested if there is any CRM system that could help them to trace association between products. They would like to retain the existing customer in providing a good service and built a good relationship with the customer. The business operation will not operate well without customer.

CRMS Web Usability Testing

The test is conducted to the clerk of Rahmath grocery shop in order to have a general browsing experience and to evaluate the general look and feel of the system. It is also for the respondent to go through CRMS features available in the system. There are two sections which are general observation and system usability scale (SUS). The findings are as below:

Respondent:

Pn Ros Hayati Binti Yaakob, clerk of Rahmath grocery shop, Taman Maju, Tronoh Perak

Developer: Aisyah Naemah Bt Mustafar

Summary of Testing:

Based on the General Observation Section, from the question "How easy it is to navigate through the website?" it is found the respondent state it is easy. It can be said that the CRMS is easy to navigate from each page to the next page. For the second questions, "Is it obvious and clear that the features are made for you to use?. The respondent state yes, as all the features is clearly meant to be for the owner, sales manager and other related user. For the last question in this section is the look and feel of the web application. The respondent stated that the size of font used, the color of the web application is suitable. The system is also consistent from pages to pages.

On the other hand, the second section which is system usability scale (SUS), is fundamental to assess the level of usability of a system. Importantly, SUS should cover the effectiveness of the system that is meant

by the ability of users to complete tasks using the system and quality of output of those tasks. There are six question that for this part and the result from the respondent as per below:

Table 9 Scale Usability Score (SUS) Result

Questions	Result by respondent
1. I think that I would like to use this system frequently	Agree
2. I found the system to be unnecessarily complex	Neutral
3. I thought the system was easy to use	Neutral
4. I think that I would need the support of a expert to be able to use this system	Neutral
5. I felt very confident with the result generate by the system	Agree
6. I need to learn a lot of things before I could get going with this system	Agree

4.3 EXPERIMENTATION/MODELLING/PROTOTYPE/PROJECT DELIVERABLES

The design model represents a blueprint of the system that needs to fulfill the requirements. The design is about producing a solution that meets the requirement that have been analyzed. The CRMS web system will be used within the business only. The main user for this system is the owner, clerk, sales manager or marketing manager of the business. There is no different in the accessibility of the system. However every user needs to register their own username and password in the system. Below are the figures and description that show the prototype of CRMS.

The login page will have simple username and password textbox (see Figure 13). This page is simple mechanism where user needs to insert username and password. Each user will have unique login account to be able to access the system. Furthermore, if the users enter invalid username and password it will show a message asking the user to enter valid username or password (see Figure 14).

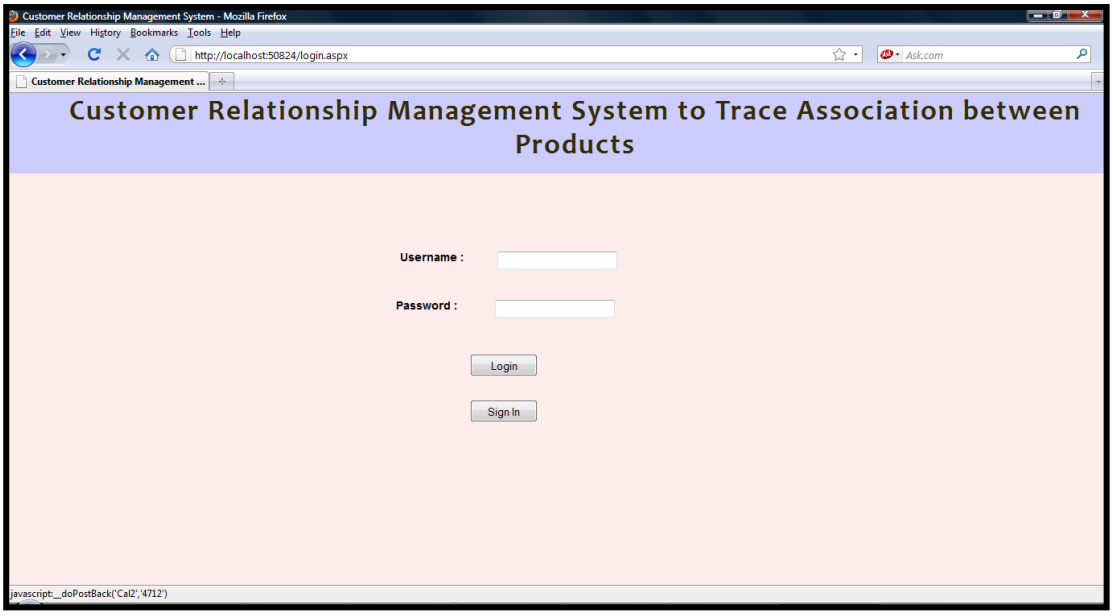

Figure 13 Login Page

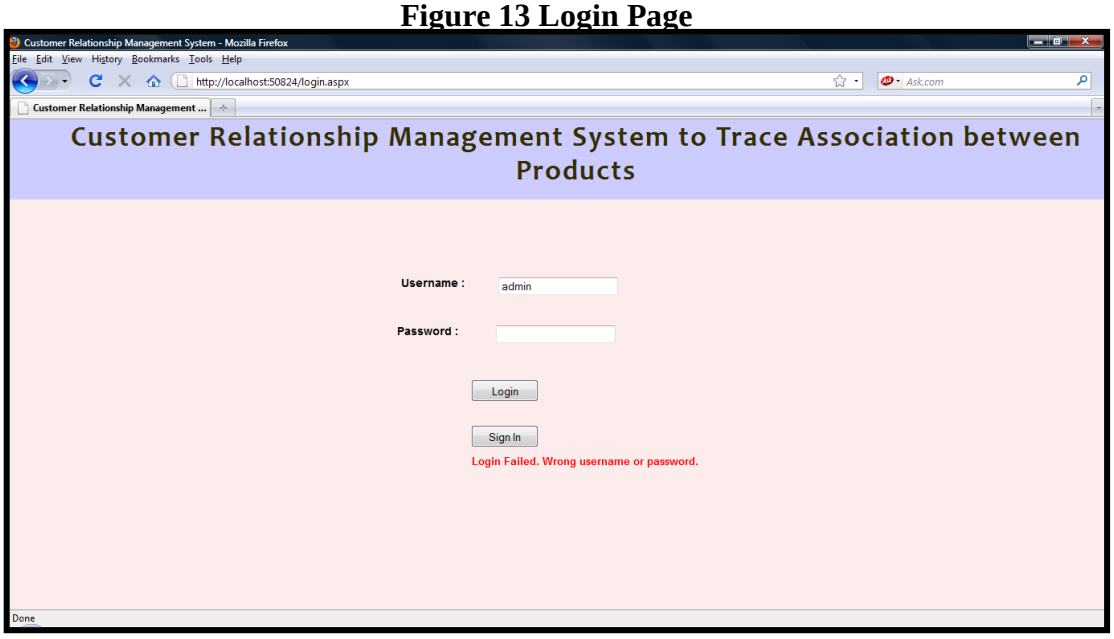

Figure 14 Warning being showed when user enter invalid password

For any user does not have an account in this system is required to sign up for an account (see Figure 15). Once the sign up is success, the user can login using the username and password registered.

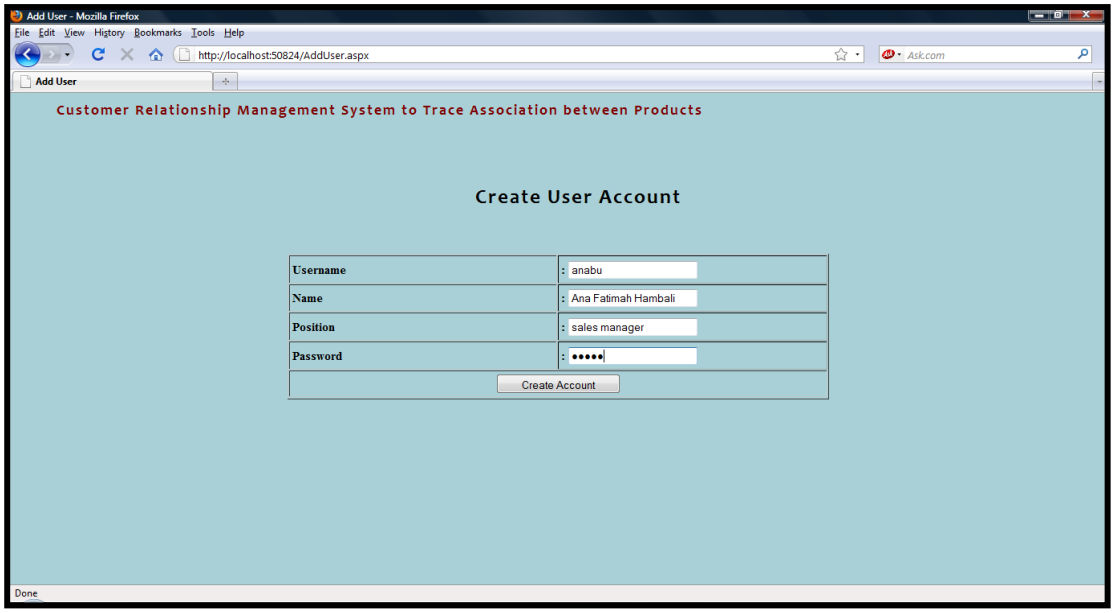

Figure 15 Create Account

The homepage of the CRMS consist of all the main functions of the system (see Figure 16). The user can select the functions in the system that they intended to view.

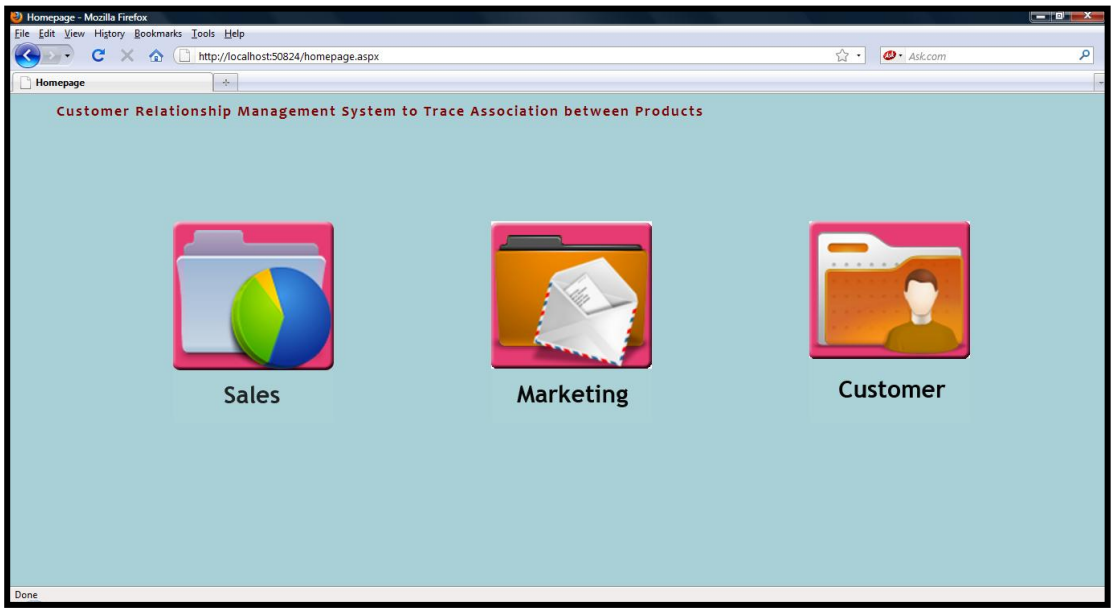

Figure 16 Homepage

Sales section is where user can view the sales of product in a specific date and categories (see Figure 17). At this section the user need to select a date and categories before generating.

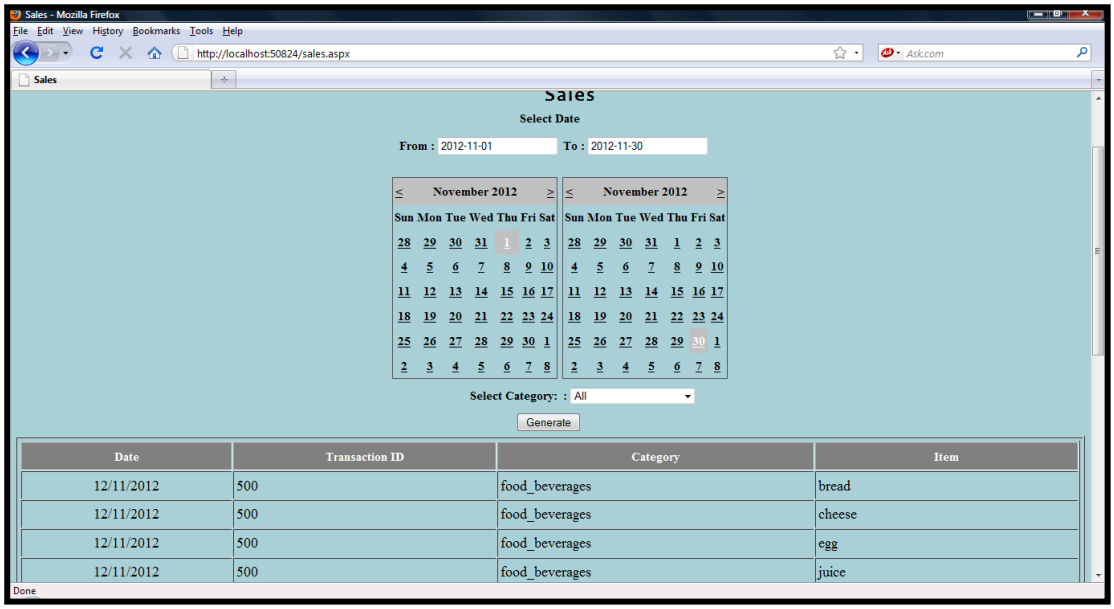

Figure 17 Sales

Marketing section is where the method of association between products is executed (see Figure 18). At this section user is need to select a date, insert the minimum support and minimum confident for the calculation before generating the result of the association between products. Minimum support is applied to find all frequent item sets in a database. Then the minimum support and confident constraints are used to form the rules. The result of support and confident of the frequent item is then compare with the value of the minimum support and confident inserted. The highest values show the most frequent item purchase together. Then the decision strategy is executed.

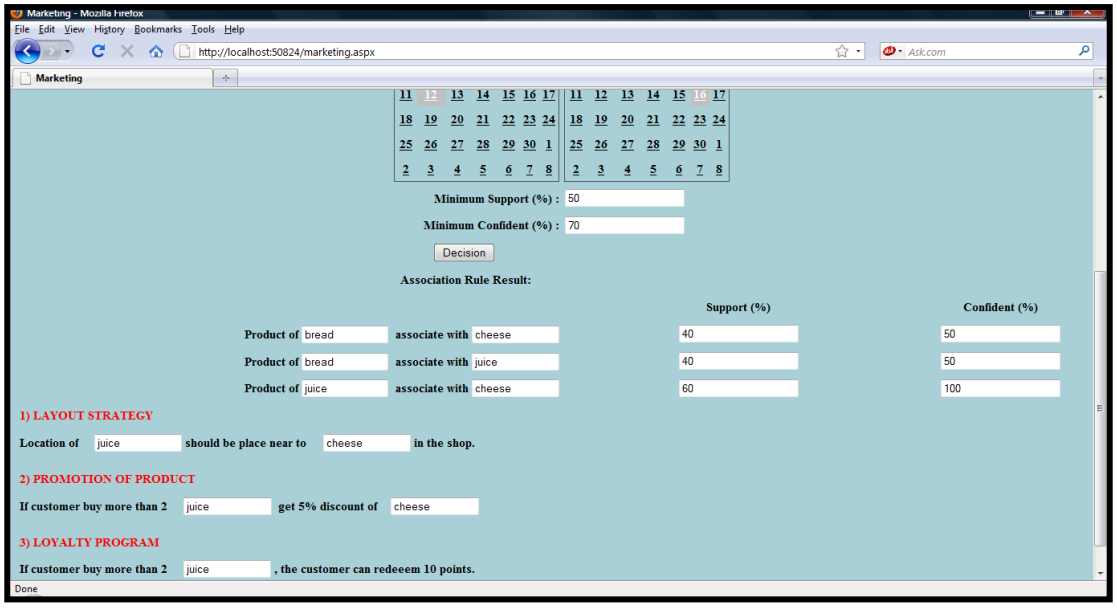

Figure 18 Marketing

Customer section, user can add the details of the customer as a membership (see Figure 20). The details are kept in the database for further promotion and tracking the customer.

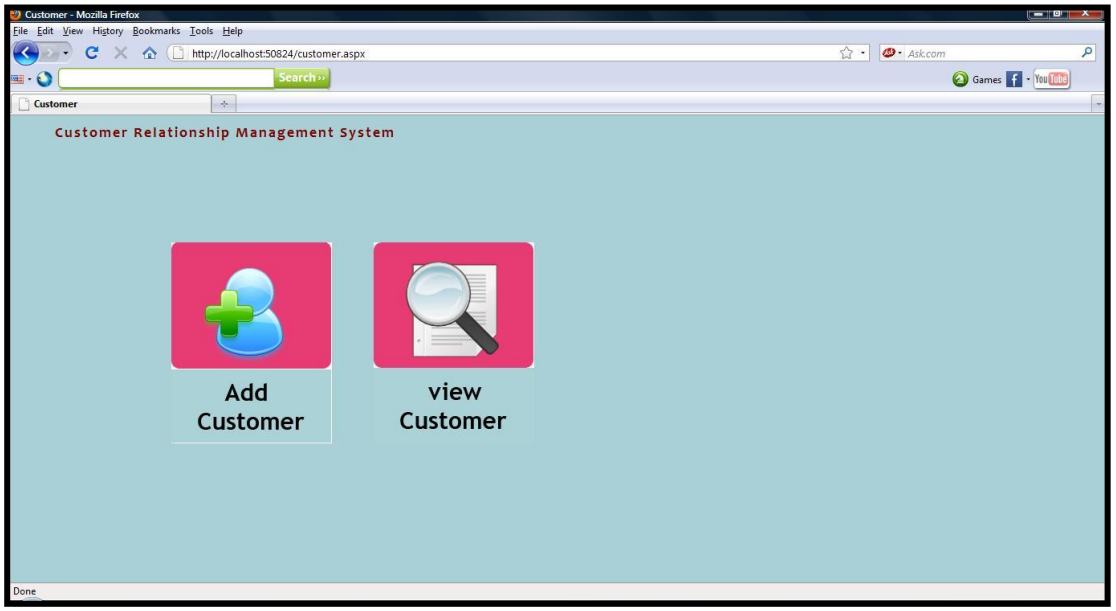

Figure 19 Customer Main Page

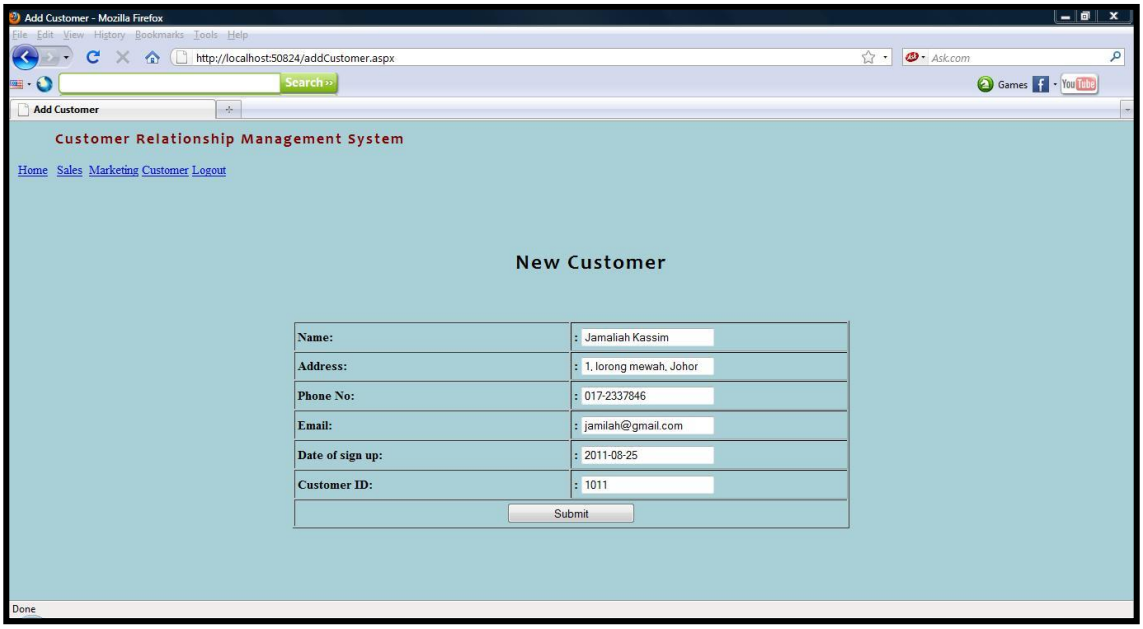

Figure 20 Add Customer Membership

View customer session, is to view the details of customer that has sign up as a member (see Figure 21). User need to insert the customer ID before executing the details.

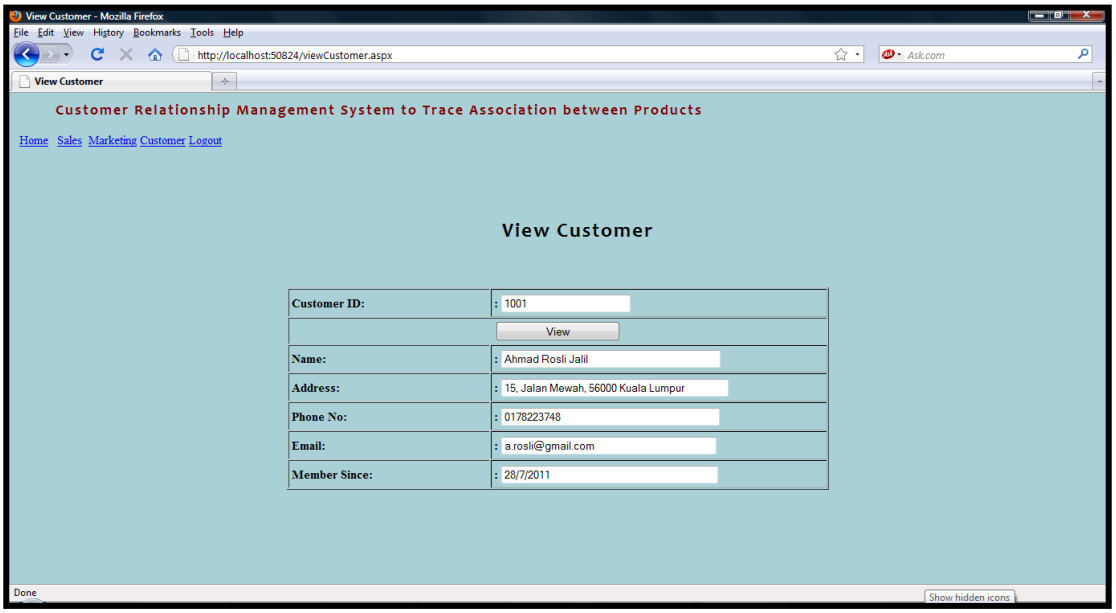

Figure 21 View customer

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 RELEVANCY TO THE OBJECTIVES

Throughout this project, the objective of this research is to identify the association between products in the new environment situation, designing and developing Customer Relationship Management System (CRMS) towards the organization, and implementing and test the prototype in the organization which is Rahmath grocery shop. Eventually, this system is primarily intended for grocery or supermarket based business. In term of relevancy, it can be concluded that it is relevant to the objectives proposed earlier where the system documentation and development is completely successful.

In conjunction with the objective of developing this system, CRMS helps to initiate the business performance by identifying the association between products. Moreover, analytical decision can be make on the information is gathered. By capturing all the data into a database, it will reduce the tendency to lost valuable information that can be used for further analysis. CRMS also offer function that captures the details of the customer which can be beneficial to the business in reaching the customer for further action. Besides the suggested decision strategy that is generated by the system, the owner and employee of the business can together come up with some other decision strategy that is the best for the business.

The proposed of the system does follow the objective and scope defined. The activities that have been conducted that include research and mostly application of theories into practices are relevant to the objective specified.

5.2 SUGGESTED FUTURE WORK FOR EXPANSION AND CONTINUATION

CRMS is a new developed system that requires some improvement and suggestion in future work expansion. In every new developed system, there is always a room for expansion as there is nothing perfect at the first time development. Currently, CRMS is only including the customer details. In a way, that the relation of the system is between the system and customers. Thus, the system can expand the relation by having the details and activity of employee and suppliers. This suggestion is proposed because; the owner would be able to monitor the employee's performance as well as the details of the suppliers. Employee plays a crucial role in running the business, therefore the employees should be evaluated and capture all their contribution that give impact on the business activity. For suppliers, capturing the details will ease in communicating with the suppliers in dealing for purchasing new stock of products.

Furthermore, CRMS can be further improving in the details of product captured in the database. Currently, the system only captures the products according to the categories. Hence the proposed is to further divide the product according to the brands. As a result, the system is able to analyze which product according to brand that has the highest frequent purchases by the customers. Customers usually tend to buy the same brands of products that they have already adapted with. However, in marketing the products is depends on the brand's company. This system only identify

with brands is mostly bought by the customers, so that the owner can increase the stock of product for that particular brand.

Last but not least, is an improvement on the features which is having a report which include chart of all the sales and employee's performance. By having this visual aid it assist the owner in monitoring the business performance in a simple and organized way. The report also can be used for presentation to show the performance of business. CRMS has the potential to be further improved and meet the needs of the business.

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APPENDIX

❖ Appendix A: LIST OF RESPONDENTS INTERVIEWED

Table 10 Respondents of interview

Element	Rahmath Grocery Shop	Halida Grocery Shop
Name	Ros Hayati Binti Yaacob	Halida Binti Ahmad
Position	Clerk	Owner

❖ Appendix B: INTERVIEW QUESTIONNAIRE

CRM System to Trace Association between Product Survey

Name:

Company:

Position:

Email:

1) Do you keep the record of customer's purchases?

☐ Yes ☐ No

2) If yes, what is the medium that you keep the record?

☐ Files ☐ System ☐ Excel / Spreadsheet

3) If it is a system, how does it works / store?

_____

4) **Do you evaluate customer's behavior through their purchases?**

☐ Yes ☐ No

5) **If yes, what criteria do you usually base on to evaluate customer's behavior?**

☐ Sales ☐ Observation ☐ Stock of product

6) **Are you interested in Customer Relationship System?**

☐ Very Interested ☐ Interested ☐ Natural

☐ Not interested ☐ Do not bother

7) **Is there is any CRM System to trace customer's behavior in your business?**

☐ Yes ☐ No

8) **If the system is implemented in your business, what is the advantage of having it?**

_____

_____

_____

_____

_____

❖ Appendix C: CRMS Web Application Usability Test

CRMS WEB APPLICATION USABILITY TEST

This survey is conducted to find out the level of usability of the web application of Customer Relationship Management System (CRMS) to trace association between products. User is given 5 to 10 minutes to browse through CRMS while being guided by the developer. The developer will guide the user and explain the available features of CRMS and try it out. Your answer will be much appreciated and will be used to improve the usability of the web application. Thank you. Please tick or circle your answer.

General Observation

1. How easy it is to navigate through the website?

1	2	3	4	5
Very Difficult	Difficult	Neutral	Easy	Very Easy

2. It is obvious and clear the features are made for you to use?

☐ Yes ☐ No

3. Look and Feel
   a. Do you find the font size used suitable?

      ☐ Yes ☐ No

   b. Are the colors chosen suitable for the web application?

      ☐ Yes ☐ No

   c. Is the system consistent from pages to pages?

      ☐ Yes ☐ No

CRMS System Usability Scale (SUS)

Please tick whichever applicable and rate the level of usability.

1. I think that I would like to use this system frequently

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. I found the system to be unnecessarily complex

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. I thought the system was easy to use

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. I felt very confident with the result generate by the system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. I need to learn a lot of things before I could get going with this system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree