CHAPTER ONE

INTRODUCTION

1.1 Research Overview

Over the years, electronic commerce has been urbanized into a most useful way of conducting business. Electronic commerce consists the buying and selling the products and services through internet or computer networks. The amount transaction conducted through electronic commerce has been growing tremendously with the widespread of internet usage. Organizations and people are trying to fully maximize the benefits from electronic commerce.

Therefore, there is a need of electronic commerce payment system which will facilitate the acceptance of electronic payment for online transactions. Conventional payment systems i.e. credit card and debit card have become the most common forms of payment for electronic commerce transactions. While electronic commerce has been growing tremendously, credit and debit cards’ weakness are becoming more apparent.

In recent years, the research and development of electronic money as an alternative payment has been growing. Electronic money can be used as alternative for micro payment. It is easier and cheaper for users to perform online transaction. Electronic money is a record of the funds or "value" available to a consumer stored on an electronic device in his or her possession, either on a prepaid card or on a personal computer for use over a computer network such as the Internet (Basle, 1996).
This research study provides overview of the proposed research, web-based electronic money. It explains the limitations of conventional payment transaction which adapted to Internet and the motivation behinds proposing the web-based electronic money as an alternative online payment method. This research also studies on current state of electronic money in Malaysia. Finally, system prototypes have been developed to demonstrate on web based electronic money concepts.

1.2 Problem Statement

Electronic commerce has been a major driver on growing business through Internet. This has led to the introduction of conventional payment system to be adapted as an online payment method to support electronic commerce. However, there are some limitations of conventional payment methods. This research study has identified several issues as highlighted below:

- **Lack of usability.** Existing conventional payment methods, i.e. credit cards and debit cards require consumers to provide a lot of information on web site interfaces before making online payment. E.g. credit card and debit card payments via a web site are not the easiest way to pay, as these require entering extensive amounts of personal data and contact details in a web form (Abrazhevich, 2004).
• **Lack of security.** Existing conventional payment methods, i.e. credit cards and debit cards has been target of risk and theft abuse. Consumers have to provide personal and account information before making online payment. Even encrypted Internet credit card transactions do not include the owner’s signature, and anyone with knowledge of the customer's credit card number, expiration date and 3 digit codes can create a payment order (Guttmann, 2003).

• **Lack of trust.** Consumers would not trust existing payment methods with the long history of fraud, misuse or low reliability. In recent years, there are many reported cases of fraud and thefts on conventional payment systems that has been used as online payment method. Potential consumers often mention this risk as the key reason why they do not trust a payment service and therefore apprehensive of using credit cards and debit cards to make Internet purchases (Lietaer, 2002).

• **Lack of eligibility.** Not everyone with money and intention to pay can make use of certain payment methods to make online payment. In the present, majority of e-commerce merchants are adopting credit card and debit card as their online payment method. In reality, not all potential buyers can obtain credit cards and debit card due to credit history limitations, low income or other reasons. In reality, this will hinder on the development of e-commerce.

• **Lack of efficiency.** Some electronic commerce payments can be too small to be handled by existing payment systems due to high administrative costs included in the processing of payments and transaction. Credit cards and debit cards are too
expensive for small payments and unsuitable for small transactions. The minimum fixed fee charged to the retailer for processing a transaction could even surpass the value of the goods sold (Guttmann, 2003).

1.3 Research Objectives

Within context of the concerns brought forward in the statement of the problem, this study therefore seeks to consider the following specific objectives:

1. To identify the main issues in the existing credit card and debit card payment method and investigate current state of electronic money in Malaysia
2. To analyze, design and implement web-based electronic money
3. To create prototype of web-based electronic money and evaluate the system

1.4 Research Significance

This research study will contribute on development of web based electronic money as an alternative online payment method in Malaysia. This research study has pursuing on designing and developing an alternative payment system to eliminate the limitations of current conventional payment system i.e. credit card and debit card. This research study will help to encourage more people to perform online shopping through the introduction of web based electronic money as new payment method. Indirectly, it will help to increase Malaysia’s economic growth and move to developed nation.
The main differentiators of the using web-based electronic money compare to current conventional payment system, credit card and debit card are:

- **Anonymity and Privacy**

  This attribute reflects the desire of users to protect their identity and personal information. In some transactions, the identities of the parties could be protected by anonymity (Abrazhevich, 2004). Anonymity suggests that it is not possible to discover someone’s identity or to monitor an individual's spending patterns. Credit cards and debit cards are not anonymous, where users require including personal information before can proceed to make online payment. Web-based electronic money is anonymous as there is no direct information about this payer’s personality associated with it. Therefore, web-based electronic money is able to protect privacy, identity and personal information.

- **Applicability**

  Applicability of a payment system is defined as the extent to which it is accepted for payments at points of sale, or at online e-commerce sites in this case (Abrazhevich, 2004). For instance, cash is accepted widely and virtually everywhere in the offline world and thus has a very high level of applicability. web-based electronic money should have high level of applicability as web online payment as it is a cost effective and acceptable on most e-commerce websites.

- **Usability**

  Usability is an important attribute of an interactive product and is defined as “the extent to which a product can be used by specified users to achieve specified goals with
effectiveness, efficiency and satisfaction in a specified context of use” (ISO 9241-11, 1998). It should not be a sophisticated or complex task to pay online, payments are to be done in an easy and user-friendly way, (Guttmann, 2003). Fewer fields required to make payment through web-based electronic money compare to credit card and debit card payment.

- **Efficiency**

Small payments are amounts less than one ringgit in Malaysia; micropayments are amounts of a fraction of a cent. A system which entertains the characteristic of efficiency should be able to process small payments and micropayments without performance degradation, and without imposing the high transaction costs (Abrazhevich, 2004). Credit cards and debit cards are too expensive for effecting small payments and are unsuited for small transactions. Web-based electronic money is suitable for small transactions as the cost of transaction is low since it contains a small amount of money compare to credit card or debit card.

- **Trust**

Trust refers to the degree of customers’ confidence that their money and personal information will be safe, and that all parties involved will not act against users’ interests (Abrazhevich, 2004). In the present situation, money loss by customers is quite possible when using existing payment systems, i.e. debit cards and credit cards, for Internet payments. Users tend not to trust existing systems with the long history of fraud, misuse or low reliability. Web-based electronic money is an alternative payment method, which is safe in view of amount of money and personal information.
• **Eligibility**

Not everyone with money and intention to pay can make use of certain payment methods. Not all potential buyers can obtain credit card and debit card due to credit history limitations, low income or other reasons. However, everyone can own Web-based electronic money to make payment for the purchase on e-commerce websites.

### 1.5 Research Scope

In brief, the scopes of this research are as follows:

1. This research study is just focusing mainly on 2 most popular conventional payment approaches namely credit card and debit card

2. This research study also include investigation on current state of electronic money in Malaysia and propose alternative online payment method to online merchants and consumers

3. The scope also covers demonstration of the concept of web-based electronic money by developing system prototype.

### 1.6 Target User

The main target user for this research will be divided into two groups which mainly are merchants and consumers. Merchants in here are defined that e-commerce owner whom would like to use web-based electronic money as one of the payment method for their e-commerce websites. Consumers in here are defined as any internet users whom would like to perform e-commerce transaction through web-based electronic money. Initially, the target merchants and consumers are based in Malaysia.
1.7 Organization of the Dissertation

This dissertation is divided into eight chapters. Below are the chapters in this report:

**Chapter One: Introduction**

This chapter is an introductory part to the research. The chapter lays the foundation upon which this research is based by presenting the background of the research, statement of the problem and objectives of the research. The chapter also provides the scope, significance and target user of the research. It ends with the organization of the research.

**Chapter Two: Literature Review**

This chapter gives brief explanation on topics researched and studies that are relevant to this research. It is the combination between literature search and literature review. This chapter also makes a study on current online payment transaction, the limitation of current online payment transaction, current state of electronic money in the Malaysia.

**Chapter Three: Research Methodology**

This chapter emphasizes on the methodology that used to complete the research and the activities that had been carried out throughout the completion of the research. A method is an organized approach to problem solving that includes 1) data gathering 2) perform analysis 3) design and coding 4) testing and evaluation 5) interpreting result 6) stating conclusion.
Chapter Four: Analysis
This chapter explains clearly of all necessary requirements before proceeding into subsequent phase. During the analysis phase, information needs and system performance criteria are defined by engaging in a variety of information-gathering activities, and developing alternative solutions.

Chapter Five: Design
This chapter explains the conceptual and technical design of the system. It covers the architecture design, functionality design, data flow diagram, database design, UML and user interface design.

Chapter Six: Implementation
This chapter explains the implementation of the system. It covers the database development, platform development and the coding approach.

Chapter Seven: Testing
This chapter presents the various types of system testing that includes the unit testing, integration testing and the system testing through the reliability of the system. Test cases are included in this chapter.

Chapter Eight: Evaluation & Conclusion
This chapter presents the system evaluation. The evaluation reveals the issue identified and how web-based electronic money can resolve the issue. It also covers the results gathered from the feedback of the users that had tested the system.
1.8 Chapter Summary

This chapter explains the overview of the proposed research, web-based electronic money. It explains the limitations of conventional payment transaction which adapted to Internet and the motivation behinds proposing the web-based electronic money as an alternative online payment method. This chapter also covers on the scope of this research, significance of the research and target user.

Chapter Two gives brief explanation on topics researched and studies that are relevant to this research. It is the combination between literature search and literature review of current online payment transaction and current state of electronic money in Malaysia.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive review of studies pertaining to online transaction payment for the purpose of introducing web-based electronic money as an alternative way of online transaction payment. It is the combination between literature search and literature review.

The main areas that cover in this chapter include research of current payment system, limitation of current payment, what is e-money and the current state of electronic money in the Malaysia. It will discuss the proposed web-based electronic money as an alternative for online payment and the benefit of web-based e-money.
2.2 Definition of Development of Web-Based Electronic Money for Online Payment Transaction

According Shanmugam et. al (2002), electronic money or "e-money" is often referred to as a monetary value instrument which is stored electronically on an electronic device such as a chip card or a computer memory. In other words, e-money represents digital money or digital currency.

Referring to Bank Negara Malaysia (2010), electronic money is a payment instrument that contains monetary value that has been paid in advance by the user. Goods and services can be purchased by users from merchants and the payment can be done through electronic money. The amount will be automatically deducted from their electronic money balance when they are paying through electronic money. Online payment transaction is a form of a financial exchange that takes place between the buyer and seller facilitated by means of electronic communications for conducting e-commerce and online purchasing.
2.3 Payment System

2.3.1 Overview of Payment System

Payment system is a funds transfer system that facilitates the circulation of money, and includes any instruments and procedures that relate to the system (Summers & White, 2008). Payment system is one of the fundamental for the modern economies. Some of the well used payment systems are cash, credit card, debit card, cheque and electronic money. For this research study purpose, we will divide payment system into conventional payment system i.e. credit card and debit card and alternative payment system i.e. electronic money.

2.3.2 Conventional Payment System

2.3.2.1 Overview of Conventional Payment System

A conventional payment system involves two parties, buyer and seller which a buyer transfers cash or payment information to seller. The payment is settled in the financial institution. For the cash payment, buyer withdraws money from his/her bank account, transfer money to seller and seller deposits the payment to his/her bank account. For non-cash payment, buyer will credit or debit money from his/her account to the seller through credit cards, debit cards or cheques.

2.3.2.2 Conventional Payment Instruments Adapted to Internet

An overview of the existing payment methods and techniques, which have been developed to adapt the conventional payment instruments for use over the Internet. This research study will focus on conventional payment instruments; credit card and debit card.
Credit cards: A credit card is a conventional payment system that entitles its holder to buy goods and services based on the holder's promise to pay for these goods and services. The issuer of the card grants a line of credit to the consumer from which the consumer can borrow money for payment to a merchant or as a cash advance to the user. Each month, a statement will be sent to cardholder on indicating the purchases undertaken with the card, outstanding fees and total amount owed. After receiving the statement, the cardholder may dispute any charges that he or she thinks are incorrect. Otherwise, the cardholder must pay a defined minimum proportion of the bill by a due date, or may choose to pay a higher amount up to the entire amount owed. The credit issuer charges interest on the amount owed if the balance is not paid in full. Credit cards are widely used for making payments over internet as they are internationally known to consumers and accepted by merchants.

Debit Card: Debit card provide a convenient way to present the cardholder information needed to debit the cardholder’s bank account. This information is embedded in the magnetic stripe (or chip) on the bank of the card. In some countries, debit cards can be used in internet shops. Internet usage operates similarly to the direct debit system, but offers additional security features for payment owing to the presence of the card. The cardholder readers are many cases provided by card-issuing bank. The use of debit cards for purchases on the internet is still relatively limited.
2.3.2.3 Limitation of Conventional Payment Instruments

Existing payment systems, such as credit cards and debit card, are inadequate for retail customer digital business from the following general viewpoints:

- **Lack of usability.** Existing conventional payment methods, i.e. credit cards and debit cards require consumers to provide a lot of information on web site interfaces before making online payment. E.g. credit card and debit card payments via a web site are not the easiest way to pay, as these require entering extensive amounts of personal data and contact details in a web form (Abrazhevich, 2004).

- **Lack of security.** Existing conventional payment methods, i.e. credit cards and debit cards has been target of risk and theft abuse. Consumers have to provide personal and account information before making online payment. Even encrypted Internet credit card transactions do not include the owner’s signature, and anyone with knowledge of the customer's credit card number, expiration date and 3 digit codes can create a payment order (Guttmann, 2003).

  Visa Debit Card and Credit card are an example of an insecure payment system since authentication is based only on “something you know”. In order to gain access to their bank account:

  a) We need to find out credit card or debit card number, expiry date, and full name.
  b) Set up a Visa-enabled merchant
  c) Debit the account.
If the victim notices that his account has been debited without his permission, Visa will force the merchant to refund the user. However, if the merchant has disappeared, Visa will refund to the user. This is a cumbersome and expensive process as merchants do not have a reliable way to verify that a credit card or debit card is being used by its registered owner.

- **Lack of trust.** Consumers would not trust existing payment methods with the long history of fraud, misuse or low reliability. In recent years, there are many reported cases of fraud and thefts on conventional payment systems that has been used as online payment method. Potential customers often mention this risk as the key reason why they do not trust a payment service and therefore do not make Internet purchases (Lietaer, 2002).

- **Lack of eligibility.** Not everyone with money and intention to pay can make use of certain payment methods to make online payment. In the present, majority of e-commerce merchants are adopting credit card and debit card as their online payment method. In reality, not all potential buyers can obtain credit cards and debit card due to credit history limitations, low income or other reasons. In reality, this will hinder on the development of e-commerce.

- **Lack of efficiency.** Some electronic commerce payments can be too small to be handled by existing payment systems due to high administrative costs included in the processing of payments and transaction. Credit cards and debit cards are too
expensive for small payments and unsuitable for small transactions. The minimum fixed fee charged to the retailer for processing a transaction could even surpass the value of the goods sold (Guttmann, 2003).

- **High usage costs for customers and merchants.** Credit card and Debit card are very expensive for consumers as they use expensive infrastructure to assist in the payment process. The growing size of fraud, which amounts to billions dollars per year is intangibly re-financed by users by the higher costs of credit card and debit card services. For online transaction, credit card and debit card are not physically available for inspection, therefore the chance of fraud is higher and charges to merchant will be higher too. Transactions fees are notably higher for internet, between 2.5% and 6% of total sales, depending on the chargeback history of the merchant. For internet transaction, payments must be approved in real time by the card issuing bank. Online authorization will help to prevent fraud but will increase handling costs for all parties involved. Average, online authorization process takes about 6 to 90 seconds. There is a risk that consumers will reject the transaction before completion due to unacceptable queuing for online authorization. If the payment fails, the merchant must either reject the payment or accept a much higher chargeback risk. In addition, credit card and debit card bills are sent in a paper form to customers by post, and the bills are mostly settled by posting paper documents, which makes the whole cycle rather expensive.
2.4 Electronic Money

2.4.1 Overview of Electronic Money

Electronic money is a payment instrument that contains monetary value that has been paid in advance by the user. Goods and services can be purchased by users from merchants and the payment can be done through electronic money. The amount will be automatically deducted from their electronic money balance when they are paying through electronic money. Online payment transaction is a form of a financial exchange that takes place between the buyer and seller facilitated by means of electronic communications for conducting e-commerce and online purchasing. (Bank Negara Malaysia, 2010)

In general, electronic money products are “stored-value” or “prepaid” products in which a record of the funds or “value” available to a consumer is stored on an electronic device in the consumer's possession. The electronic value is reduced whenever the consumer uses the device to make purchases and intended to be used as a multipurpose means of payment. Electronic money allows consumers to use electronic means of communication to make payment. Banks may participate in electronic money schemes as issuers or distribute electronic money issued by other entities; redeeming and maintaining electronic money transactions for merchants; handling the processing, clearing, and settlement of electronic money transactions.
2.4.2 Current State of Electronic Money in Malaysia

The continuous change from paper-based payments to electronic form is obvious from the rising trend in the number of electronic payment transactions recorded in 2008. The motivating force for this upward trend is the consumer demand for fast, convenient and secure transactions, as well as the merchants’ efforts in improving business processes and lowering costs.

Payment cards are still the most popular e-payment mode used in Malaysia with electronic money (e-money) recording the highest number of transactions and credit cards leading the way in terms of amount spent. At the same time, the e-money industry continued to gain reputation as an alternative payment instrument for micro payments in Malaysia, representing more than half of non-cash transactions performed in the economy. Table 2.1 shows the Malaysia’s payment statistic from 2004 to 2008.
Table 2.1: Malaysia’s Payment Statistic (Bank Negara, 2009)

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
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</thead>
<tbody>
<tr>
<td>Population (million)</td>
<td>25.6</td>
<td>26.1</td>
<td>26.6</td>
<td>27.2</td>
<td>27.7</td>
</tr>
<tr>
<td>GDP (RM million)</td>
<td>474,048</td>
<td>522,445</td>
<td>574,441</td>
<td>639,776</td>
<td>738,677</td>
</tr>
<tr>
<td>Cash in circulation (CIC) (RM million)</td>
<td>28,616.9</td>
<td>30,177.6</td>
<td>33,519.4</td>
<td>36,247.1</td>
<td>40,424.6</td>
</tr>
<tr>
<td><strong>Volume (unit)</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>Per capita:</strong></td>
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<tr>
<td>Cheque</td>
<td>7.8</td>
<td>7.7</td>
<td>7.6</td>
<td>7.8</td>
<td>7.5</td>
</tr>
<tr>
<td>E-payments:</td>
<td>18.3</td>
<td>22.5</td>
<td>29.3</td>
<td>34.3</td>
<td>38.1</td>
</tr>
<tr>
<td>Credit card</td>
<td>6.4</td>
<td>7.1</td>
<td>7.8</td>
<td>8.7</td>
<td>9.4</td>
</tr>
<tr>
<td>Charge card</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Debit card</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>E-money</td>
<td><strong>10.9</strong></td>
<td><strong>14.0</strong></td>
<td><strong>19.4</strong></td>
<td><strong>22.6</strong></td>
<td><strong>24.8</strong></td>
</tr>
<tr>
<td>Interbank GIRO</td>
<td>0.1</td>
<td>0.4</td>
<td>0.7</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>FPX</td>
<td>...</td>
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<td>...</td>
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<td>...</td>
</tr>
<tr>
<td>ATM¹</td>
<td>...</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Internet banking²</td>
<td>0.4</td>
<td>0.6</td>
<td>0.9</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Mobile banking²</td>
<td>n.a.</td>
<td>...</td>
<td>...</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>RENTAS³</td>
<td>n.a.</td>
<td>n.a.</td>
<td>...</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Value (RM)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Per capita:</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>CIC</td>
<td>1,118.7</td>
<td>1,155.0</td>
<td>1,258.2</td>
<td>1,333.9</td>
<td>1,457.9</td>
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<td>Cheque</td>
<td>53,418.2</td>
<td>51,964.1</td>
<td>54,127.6</td>
<td>63,078.3</td>
<td>63,528.8</td>
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<tr>
<td>E-payments:</td>
<td>2,577.3</td>
<td>3,517.9</td>
<td>22,114.3</td>
<td>222,011.9</td>
<td>283,798.6</td>
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<tr>
<td>Credit card</td>
<td>1,363.3</td>
<td>1,565.3</td>
<td>1,785.1</td>
<td>2,068.6</td>
<td>2,354.6</td>
</tr>
<tr>
<td>Charge card</td>
<td>82.3</td>
<td>82.8</td>
<td>87.8</td>
<td>89.0</td>
<td>110.4</td>
</tr>
<tr>
<td>Debit card</td>
<td>6.5</td>
<td>10.0</td>
<td>24.4</td>
<td>41.5</td>
<td>70.6</td>
</tr>
<tr>
<td>E-money</td>
<td><strong>28.7</strong></td>
<td><strong>37.7</strong></td>
<td><strong>47.8</strong></td>
<td><strong>60.3</strong></td>
<td><strong>74.2</strong></td>
</tr>
<tr>
<td>Interbank GIRO</td>
<td>550.4</td>
<td>1,006.9</td>
<td>1,717.4</td>
<td>2,464.0</td>
<td>3,232.0</td>
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<tr>
<td>FPX</td>
<td>0.1</td>
<td>0.5</td>
<td>0.9</td>
<td>16.7</td>
<td>36.3</td>
</tr>
<tr>
<td>ATM¹</td>
<td>6.2</td>
<td>146.5</td>
<td>80.6</td>
<td>167.6</td>
<td>45.9</td>
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<td>Internet banking²</td>
<td>539.7</td>
<td>668.0</td>
<td>940.3</td>
<td>1,602.5</td>
<td>1,630.8</td>
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<tr>
<td>Mobile banking²</td>
<td>n.a.</td>
<td>0.2</td>
<td>0.4</td>
<td>0.8</td>
<td>2.6</td>
</tr>
<tr>
<td>RENTAS³</td>
<td>n.a.</td>
<td>n.a.</td>
<td>17,429.5</td>
<td>215,500.8</td>
<td>276,241.2</td>
</tr>
</tbody>
</table>

¹ ATM: Automated Teller Machine
² Internet banking: Online banking, Mobile banking, E-money
³ RENTAS: Retail Electronic Transfer and Access System
The history of e-money implementation in Malaysia was in 1999 with the introduction of MEPS cash in the Klang Valley. The initial response was not encouraging at all due to limited facilities to reload the cards and few outlets that accept MEPS. However, the situation is quite different today where almost every ATM machine in the country is equipped with the ability to reload MEPS cash. The Touch ‘n Go cards were originally intended for toll payments along the Malaysian highways. Touch ‘n Go card is an electronic purse that can be used at all highways in Malaysia, major public transports in Klang Valley, selected parking sites and theme parks. Touch ‘n Go uses contactless smartcard technology and it looks similar to a credit card. Consumer can continue using the card as long as it is pre-loaded with electronic cash. Consumer can reload the card at toll plazas, train stations, Automated Teller Machines, Cash Deposit Machines, Petrol kiosks and at authorised third party outlets. Reload denomination is ranging from RM20 to RM500.

Tune Money Sdn Bhd announced that they will have over 1,400 new offline payment locations for online shoppers by the year end of 2009. The aim is to shop online but pay locally with cash. This solution targets non-credit card shoppers and should dramatically increase their access to online products and services. This is another electronic money implementation in Malaysia. MOLePoints is another sample of online micropayment (web based electronic money) system developed and operated by MOL AccessPortal Berhad (MOL). This payment system enables consumers nationwide to purchase online products and services via the portal www.mol.com and pay at over 200,000 channels across more than 50 countries worldwide. There are over 15,000 physical and virtual payment channels nationwide across Malaysia. Consumers can register for free to become MOL Members on
the portal www.mol.com and can then proceed to purchase products and services at the portal. (http://www.mol.com).

M-Money is an online micropayment (web based electronic money) system developed and operated by Maxis Mobile Sdn Bhd (Maxis). Maxis M-money is a secure and convenient way to pay for products and services using your mobile phone. Imagine your phone acting like an electronic wallet! The innovative service enables you to open an electronic money (Maxis M-money) account. The Maxis M-money can be used to perform cashless transactions via SMS, such as purchase goods and services, top up hotlink account, pay postpaid bill and make M-money transfer to friends and family. You can also convert the Maxis M-money into cash and vice versa. (http://www.maxis.com.my)

Table 2.2 shows the list of e-money issuer that has been approved by Bank Negara Malaysia.
Table 2.2: List of E-Money Issuer (Bank Negara, 2009)

<table>
<thead>
<tr>
<th>Banks</th>
<th>Non-banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. AmBank (M) Berhad</td>
<td><strong>Small E-money Scheme</strong></td>
</tr>
<tr>
<td>2. Bank Islam Malaysia Berhad</td>
<td><em>Maximum purse size of RM200</em></td>
</tr>
<tr>
<td></td>
<td>5. JST Technology Sdn. Bhd.</td>
</tr>
<tr>
<td></td>
<td><strong>Large E-money Scheme</strong></td>
</tr>
<tr>
<td></td>
<td><em>Maximum purse size of RM500</em></td>
</tr>
<tr>
<td></td>
<td><em>Maximum purse size of RM1,500</em></td>
</tr>
<tr>
<td></td>
<td><em>Maximum purse size of RM2,000</em></td>
</tr>
<tr>
<td></td>
<td><em>Maximum purse size of RM10,000</em></td>
</tr>
</tbody>
</table>
2.4.3 Proposed Web-based Electronic Money

Current state of e-money in Malaysia is limited to the usage of own product e.g. Maxis M-Money is only focus on the communication services provided by Maxis. MEPS and Touch n Go is not used for offline transaction. Tune Money and MOLePoints allow customer to purchase online but they need to make payment through an offline channels. Hence, by enhancing the current state of e-money in Malaysia, this research propose to develop an online anonymous web-based e-money to allow consumers able to perform online transaction to e-commerce website where the merchant have subscribe to the proposed e-money services.

Web-based electronic money is an alternative payment method which enables users to store funds on a device or through the Internet and to make web payment transactions. The proposed Web-based electronic money can be used and benefits in many types of e-commerce. Below is the proposed web based electronic money for:

- **Online book stores**
  People can make online book stores purchase via web to buy multimedia, stationary, books and etc. Some of the stuffs are less than RM 10 and many users would find it is worth to purchase from online to get their items.

- **Online magazines and newspaper**
  People are willing to pay for physical newspapers and magazines but tend to be less willing to pay for the same kind of content on the Internet. If a pervasive
micropayment solution such as the proposed web-based electronic money where payments could be done with a single click, many users would find it is worth paying for example RM 1 to view an article.

- **Online music and videos**
  
The proposed web-based electronic money could be used to charge for example RM 1 to listen to a song directly online or to download it.

- **Software**
  
  Independent software developers could charge small amounts of money for their software components. Today most software is either free or costs more than RM 10. The proposed web-based electronic money would make it possible to charge for example RM 1 to download and test the software.

- **Games**
  
  An online game might charge RM 1 for player to play for the game. Betting games are also a strong candidate for these types of payment solutions.

Those e-commerce businesses as mentioned above are very suitable to use web based electronic money due to small transactions (micro-payment) where conventional payment method such as Credit Card and Debit Card are not developed for micro payment. For this research study purpose, we will create a system prototype based to demonstrate on the web-based electronic money as an alternative web payment method for online book store.
Since the proposed web-based electronic money is mainly cater for micro payment, therefore this research will propose maximum purse of RM 500 for online book stores which allows purchase stationary, multimedia, books and etc. In future, the issuer can partner with financial institutions to get higher purse amount as one of the conditions set by Bank Negara Malaysia due to risk and liabilities issue.

### 2.4.4 How Does Web-based Electronic Money Work?

![Web-based Electronic Money Workflow Diagram](image)

**Figure 2.1: Web-based Electronic Money Workflow Diagram**

Below is the core process of Web-based Electronic Money workflow:

1. Issuer sell prepaid web-based electronic money card to public (customer)

2. Customer makes online payment when they purchase product from e-commerce merchant that accept prepaid web-based electronic money as their payment method.

3. E-commerce Merchant request for validation.

4. Issuer validates and deducts prepaid amount and make payment to e-commerce merchant.

5. E-commerce Merchant sends receipt to customer.
2.4.5 Benefits of Proposed Web-based Electronic Money

Below are the benefits of proposed Web-based electronic money comparing to conventional payment method such as credit and debit card:

- **Anonymity, privacy**
  This attribute reflects the desire of users to protect their privacy, identity and personal information. In some transactions, the identities of the parties could be protected by anonymity (Abrazhevich, 2004). Anonymity suggests that it is not possible to discover someone’s identity or to monitor an individual's spending patterns. Credit cards and debit cards are not anonymous, where users require including personal information before can proceed to make online payment. Thus, cash is an anonymous payment system. E-money acts in the same way as cash payment but it is used in electronic or online payment. Web-based electronic money is anonymous as there is no direct information about this payer’s personality associated with it. Therefore, web-based electronic money is able to protect privacy, identity and personal information.

- **Applicability**
  Applicability of a payment system is defined as the extent to which it is accepted for payments at points of sale, or at online e-commerce sites in this case (Abrazhevich, 2004). For instance, cash is accepted widely and virtually everywhere in the offline world and thus has a very high level of applicability. Not all web sites support a particular payment method such as credit card and debit card,
thus limiting customers’ ability to pay. Therefore, e-money has been proposed as one of the online payment instrument as a cost effective solution for all the e-commerce websites.

- **Usability**

Usability is an important attribute of an interactive product and is defined as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (ISO 9241-11, 1998). It should not be a sophisticated or complex task to pay online, payments are to be done in an easy and user-friendly way, (Guttmann, 2003). For example, the processes of paying when you have to fill in a lengthy form with name, address details, a 16-digit credit card number plus expiration date cannot be called an easy one when compared with cash payments. For e-money, users require to input serial number and validation code to perform online payment. This will replace the complexity of existing payment through credit card, debit card and etc.

- **Efficiency**

Small payments are amounts less than one ringgit in Malaysia; micropayments are amounts of a fraction of a cent. A system which entertains the characteristic of efficiency should be able to process small payments and micropayments without performance degradation, and without imposing the high transaction costs (Abrazhevich, 2004). Credit cards and debit cards are too expensive for completing small payments and are unsuited for small transactions. The costs per transaction should be practical for processing small amounts. Credit cards and debit cards are too expensive for completing small payments and are unsuited for small payments.
transactions. Web-based electronic money is suitable for small transactions as the cost of transaction is low since it contains a small amount of money compare to credit card or debit card.

- **Trust**

Trust refers to the degree of customers’ confidence that their money and personal information will be safe, and that all parties involved will not act against users’ interests (Abrazhevich, 2004). From the perspective of using a payment system, users need to trust that payments will be conducted in a proper way, and that their money will not be stolen or misused. In the present situation, money loss by customers is quite possible when using existing payment systems, i.e. debit cards and credit cards, for Internet payments. Users tend not to trust existing systems with the long history of fraud, misuse or low reliability. Web-based electronic money is designed in such a manner to regain consumer trust as an alternative and new online payment instrument and help in growing electronic commerce since it does not carry any personal information and contains a small amount of money.

- **Eligibility**

Not everyone with money and intention to pay can make use of certain payment methods. Not all potential buyers can obtain credit card and debit card due to credit history limitations, low income or other reasons. Web-based electronic money has been introduced to solve this limitation and everyone can own and buy web-based electronic money card to perform online payment transaction.
• **Security**

Security can be viewed as a two-fold issue where consumers would like to ensure that their money is safe when paying online and banks and payment services organizations would like to ensure that no money, financial, or personal information can be stolen or misused. Web-based electronic money has been introduced to solve this limitation as it carry no personal information and contains a small amount of money.
2.5 Comparison between Current Electronic Money with Conventional Payment System

The table provides a brief comparison of the characteristics of current electronic-money systems with credit card payment system, and debit card systems. The aim of this comparison is to visually present the basis advantages and disadvantages of current payment system.

Table 2.3: Comparison between Current Payment System Characteristic

<table>
<thead>
<tr>
<th></th>
<th>Current Money</th>
<th>Electronic</th>
<th>Online Credit Card Payment</th>
<th>Debit Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Payment Time</td>
<td>Postpaid</td>
<td>Postpaid</td>
<td>Prepaid</td>
<td></td>
</tr>
<tr>
<td>Transaction information transfer</td>
<td>Product owner (Maxis etc) checks the status of transaction</td>
<td>The store and bank checks the status of the credit card</td>
<td>The store and bank checks the status of the debit card</td>
<td></td>
</tr>
<tr>
<td>Online and offline transactions</td>
<td>Offline transactions</td>
<td>Online and offline transactions</td>
<td>Online and offline transactions</td>
<td></td>
</tr>
<tr>
<td>Bank account involvement</td>
<td>No involvement but involves product owner (Maxis etc)</td>
<td>Credit card account makes the payment</td>
<td>Debit card account makes the payment</td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>Account’s owner</td>
<td>Any legitimate credit card users</td>
<td>Any legitimate debit card users</td>
<td></td>
</tr>
<tr>
<td>Party to which payment is made out</td>
<td>Store</td>
<td>Distributing Bank</td>
<td>Store</td>
<td></td>
</tr>
<tr>
<td>Consumer’s transaction risk</td>
<td>Consumer is at risk of the electronic cash getting stolen, lost, or misused.</td>
<td>Most of the risk is borne by the distributing bank, consumers only have to bear part of the risk</td>
<td>Consumer is at risk of the debit card getting stolen, lost, or misused.</td>
<td></td>
</tr>
</tbody>
</table>
2.6 Chapter Summary

This chapter focused on the research of the problem that encounter on current online payment. It included the research and analysis to the existing online payment. It involved several important components that are needed to propose web-based electronic money as an alternative online payment transaction.

From the research of the existing system, there are many types of conventional payment instruments that are widely used in online transaction. Web-based electronic money is a new initiative, termed as innovative payment instruments which allow online payment for e-commerce websites. This is used to solve the anonymity, privacy, trust, efficiency, usability, eligibility and security concern compare to existing conventional payment method.

Research about the methodologies and techniques that are used for the research of online payment system and methodology to develop the prototype system of web-based electronic money will be discussed in next chapter.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

There are multiple approaches applied in order to achieve the research objectives. A method is an organized approach to problem solving that includes 1) data gathering 2) perform analysis 3) design and coding 4) testing and evaluation 5) interpreting result 6) stating conclusion. The methods that are used for this research will be discussed in this chapter.

At first, a literature review is conducted into three main areas. Few methods are being used to gain more knowledge on the research topics. The methods include reading materials, online surfing and document analysis. Few areas are covered during the literature review. The first area presents the study on the current online payment transaction. In the second area, the limitation of current online payment transaction is comprehensively discussed. The last part of the second area lays out analysis and discussion of why web-based electronic money is introduced as a replacement/alternative online payment transaction.

Then, after literature review, questionnaire is prepared to gather information before proceed with system design. A brainstorming session is carried out upon the findings of the literature review and summary of questionnaire result to come up with multiple visualization types which could possibly be demonstrate the concept of web-based
electronic money. The result of the brainstorming session along with result from of the questionnaire formulates a conceptual diagram to illustrate how web-based e-money process, extracted visualization types from the brainstorming session; system prototype is developed to demonstrate the concept of web-based electronic money.

To develop the web-based electronic money prototype, prototyping methodology has been used. The development of electronic money prototype system begins with the identification of the functional and non functional requirements in the analysis phase. Then, the design phase is based on the identified requirements. The implementation and test phase of the system ends the development process.

At last, system evaluation is carried out to ensure that the developed prototype system meet the identified requirements and thus the research objectives. The result of the system’s evaluation is captured and documented for future enhancement and improvement.

Figure 3.1 demonstrates the summary of the entire research methodology process.
Figure 3.1 Research Methodology Process
3.2 Literature Review

During literature review, few methods have been used includes reading materials, online surfing and documents analysis. The combine methods are being used to perform literature review in order to gain more understanding on the research topics through published literatures and useful websites. Those documents are later being analyzed in order to have a clear idea on the research topic.

3.2.1 Reading Materials

A lot of published literatures have been read in order to gather information of the users’ needs, system development needs and technical issues of the proposed system. All these can be categorized into the printed material (especially books and journal) and non-printed material such as electronic document. Through reading, ideas are managed to get from books, magazines and journal to be implemented in the proposed system.

3.2.2 Online Surfing

Internet is being used to seek information on the web latest technologies, existing online systems and information related to the research. Site visits and joining related newsgroups on the World Wide Web (WWW) are important to obtain a vast amount of up-to-date information from all around the world. Besides that, online tutorials regarding programming language can also be obtained through surfing the Internet.
3.2.3 Document Analysis

Existing documents are then analyzed to understand the current system and its operations. By understanding the existing system, strengths and weaknesses of current system can be identified and thus help to design a better system. The types of documents that have been analyzed were the documents regarding to current online payment transaction, electronic money, electronic commerce, electronic payment method and e-money in Malaysia. Those documents provide a lot of information about the history of money and payment system, the advantages and disadvantages of payment methods, fraud related to each payment methods and the initiatives of web based electronic money. There are some documents regarding the e-money establishment in Malaysia. From the documents, some information regarding the electronic money such as information on e-money issuer, payment workflow and electronic commerce are extracted.

3.3 Questionnaire

Another way of getting more information, a questionnaire form has been created. About 100 questionnaire forms have been passed to internet users and online merchant. But only 63 respondents participate in the survey. Based on their answers from 63 questionnaire forms that have been received, a few of important issue regarding the electronic money had been identified. The analysis based on the result from the questionnaire had been prepared and there are graphs to analyze the desire of customer to perform online purchasing, preferable payment method they use during online purchasing, the purchasing power through internet. The summary of the reports can be found in the previous chapter in section 2.4.6.
3.4 Brainstorming

During problem analysis, brainstorming session had been carried out to identify all possible constraints on the problem’s solution. At this time there is a considerable expansion of information and knowledge about the problem. The greatest problems that occur during this time are finding ways of trading off constraints and organizing the plethora of information.

Some meetings session with other lecturers and students had been carried out to share ideas and discuss problems related to this research. Discussions with colleagues and friends that have performing online shopping have also been conducted as well with few online merchants.

3.5 System Development Methodology

The software engineering process consists of a set of steps that encompass methods, tools, and procedures. These steps are often referred to as methodologies or software life-cycle models. The model is chosen based on the nature of the project and applications, the methods and tools to be used, and the controls and deliverables that are required.

Prototyping Model has been used in developing the system. The art of prototyping has evolved from the use of pen-and-paper layout charts to being the basis for Evolutionary Prototyping, a full methodology for developing software systems. While prototyping is discussed in introductory systems analysis and design courses, students gain a better appreciation of the technique by actually developing different types of prototypes. For example, prototyping is an excellent vehicle for demonstrating the overlapping of phases in the SDLC.
3.5.1 Prototyping Methodology

Prototyping methodology is now as fundamental to software development as it has been to systems development in other engineering fields. Satzinger, et al., state that prototyping is used "in almost every software development project in some way" and McConnell proposes that prototyping can be used "in one form or another on most kinds of software projects regardless of what other practices are used" The use of prototyping has been developed to the level of being the basis for software development methodologies, such as the Evolutionary Prototyping lifecycle model Sommerville states that the evolutionary prototyping methodology "is now the normal technique used for web-site development and ecommerce applications. (Robert F. Zant, 2005)

Figure 3.2: Prototyping Methodology

(Lantz, K. E. 1987. The Prototyping Methodology, Prentice-Hall)
3.6 Evaluation

After the development of system prototype, the system is exposed to 60 users, 30 consumers and 30 merchant for testing purpose. All users fill up an evaluation form to provide the feedback on the system to measure the functionalities of the system and to measure the usability, security, eligibility and other issues that had been identified in chapter two. The evaluation result is used to proof the developed system will resolve the issues identified.

3.7 Conclusion

Finally a conclusion is made from the result of the evaluation that whether the research meets the objectives and solves the problem identified.

3.8 Chapter Summary

Chapter three discusses about the methodology of research. Various techniques used during literature review such as the reading materials, online surfing and document analysis. Questionnaire had been practiced and brainstorming session had carried out. Then prototyping methodology has been chosen as the framework to develop the system. Evaluation also being carried out and finally conclusion had been made.

The next chapter presents the system analysis of the project. Discussion will focus in the requirement that needed such as functional requirements, non-functional requirements and software and hardware requirements. Technologies that been chosen to develop the system also been discussed in the next chapter.
CHAPTER FOUR

ANALYSIS

4.1 System Analysis

System analysis is an essential and important phase in software life cycle that is used to determine clearly of all necessary requirements before proceeding into subsequent phase. During the analysis phase, information needs and system performance criteria are defined by engaging in a variety of information-gathering activities, and developing alternative solutions. Analysis from the questionnaire result is important to define the requirements of the proposed solution.

4.1.1 Purposes

- Acquire knowledge on how the current available web-based electronic money.
- Researching on how this system can be developed using current or maybe latest new emerging technologies.
- Gain an overall understanding of system data flow and systems work.
- Identifying major components to be included.
- Create a system specification definition that describes both the functional and non-functional requirements.
4.2 Requirements Analysis

System requirements define the services that should be provided by the system and prescribe constraints for its operation. In documenting the system requirements for a new information system, an analyst will likely identify dozens of unique requirements. Requirements are often categorized as functional versus nonfunctional.

4.2.1 Functional Requirement

A functional requirement is a function or feature that must be included in an information system to satisfy the business need and be acceptable to the users. Functional requirement state what the system should provide, how the system should react to particular input and how they should behave in particular situation. Furthermore, it is independent from the implementation of the solution. In this research, the main function of web-based e-money is to make payment for online transaction anonymously. But in order to demonstrate the function, an E-commerce web site is included in the analysis and design.

4.2.1.1 Web-based Electronic Money Module

The main purpose of the web-based electronic money is to demonstrate the payment for online transactions can be performed anonymously through web-based electronic money. This module will gather together all the information for the electronic commerce transaction, process them and the payment is done through web-based electronic money.

There are 3 sub modules in the web-based electronic money module, providing the following features:
Table 4.1: E-Money Issuer Module

<table>
<thead>
<tr>
<th>Sub Module</th>
<th>E-Money Issuer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usage</strong></td>
<td>Allow creation and listing of web-based electronic money card and partner (merchant) listing</td>
</tr>
<tr>
<td><strong>Requirement</strong></td>
<td>▪ Able to create serial number for e-money card</td>
</tr>
<tr>
<td></td>
<td>▪ Able to deduct the usage of e-money card in real time</td>
</tr>
<tr>
<td></td>
<td>▪ Able to list all the e-money card</td>
</tr>
<tr>
<td></td>
<td>▪ Able to list all the partner (merchant) payment detail for the usage of e-money card</td>
</tr>
</tbody>
</table>

Table 4.2: E-Money Partner (Merchant) Administrator Module

<table>
<thead>
<tr>
<th>Sub Module</th>
<th>Administrator Module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usage</strong></td>
<td>Allowing administrator to create shopping items, new users and view transaction history</td>
</tr>
<tr>
<td><strong>Requirement</strong></td>
<td>▪ Able to add shopping items</td>
</tr>
<tr>
<td></td>
<td>▪ Able to create new users for e-commerce purpose</td>
</tr>
<tr>
<td></td>
<td>▪ Able to let users perform shopping</td>
</tr>
<tr>
<td></td>
<td>▪ Able to let users check amount of e-money card</td>
</tr>
<tr>
<td></td>
<td>▪ Able to link e-money payment system to e-money issuer</td>
</tr>
<tr>
<td></td>
<td>▪ Able to view entire transaction history</td>
</tr>
<tr>
<td>Sub Module</td>
<td>User Module</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Usage</td>
<td>Allowing users to perform online shopping, make payment and view transaction history</td>
</tr>
</tbody>
</table>
| Requirement | • Able to view shopping cart  
              • Able to add shopping cart  
              • Able to check the amount of e-money card  
              • Able to perform e-money payment.  
              • Able to view transaction history |

### 4.2.2 Use Case Diagram

A use case is a set of scenarios that describing an interaction between a user and a system. A use case diagram displays the relationship among actors and use cases. The two main components of a use case diagram are use cases and actors.

![Use Case Diagram Components](image)

**Figure 4.1: Use case Diagram Components**

An actor is represents a user or another system that will interact with the system you are modeling. A use case is an external view of the system that represents some action the user might perform in order to complete a task.
Figure 4.2: Web-based E-Money Use case Diagram
4.2.2.1 Use Case Specification

Complete use case specification is included in Appendix A, below are two examples of use case specifications and the explanations.

**Table 4.4: Use Case Specification: Shopping Cart**

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary  : users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary  : System → Passive (Add item and sum price total).</td>
</tr>
<tr>
<td>Brief Description</td>
<td>This use case allows users to perform online shopping</td>
</tr>
<tr>
<td>Activation Condition(s)</td>
<td>Upon Request.</td>
</tr>
<tr>
<td>Pre-Condition(s)</td>
<td>Item had been created by administrator</td>
</tr>
</tbody>
</table>
| Flow of Event(s)  | 1. This use case starts when user add item to shopping cart  
|                  | 2. Price of item being added into total  
|                  | 3. User continue make payment or quit  
|                  | 4. User case end. |
| Extended Use Case | Make Payment |

The primary actor for “Shopping Cart” use case will be the users and when adding item and summing price total there will be a passive actor (the system). This use case describes how users perform online shopping. The activation condition is upon request. The flow of events are: user add item to shopping cart, then the price of item will be added into the total, user can continue to make payment or quit the system. There is a extended use case call “Make Payment” use case.
Table 4.5: Use Case Specification: Pay to Partner

| Actor(s)                  | Primary : administrator  
<table>
<thead>
<tr>
<th></th>
<th>Secondary : System → Passive (Retrieve partner information).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief Description</td>
<td>This use case allows administrator to view and pay to partner</td>
</tr>
<tr>
<td>Activation Condition(s)</td>
<td>Upon Request.</td>
</tr>
<tr>
<td>Pre-Condition(s)</td>
<td>Partner information exist in system</td>
</tr>
</tbody>
</table>
| Flow of Event(s)         | 1. This use case starts when administrator request to view partner information  
|                          | 2. The system display partner list and money value need to pay  
|                          | 3. Enter cheque information                                   |
|                          | 4. System recalculate remaining money value                    |
|                          | 5. Use case ends.                                             |

“Pay to Partner” use case is used when administrator wish to view and pay to partner. The actor for this use case is administrator and passive actor will be the system (retrieve partner information). Activation condition will be upon request. Flow of events is: administrator request to view partner information, then the system will display partner list and amount of money value that need to be paid. Administrator then enters cheque information and system will recalculate the remaining money value.
4.2.3 Non-Functional Requirement

A non-functional requirement is a description of the features, characteristics, and attributes of the system as well as any constraints that may limit the boundaries of the proposed solution. The non-functional requirements of this system are very subjective but they are as important as the functional requirements. The non-requirements of the system are:

- **Anonymity**

  The proposed system needs to be anonymous which means the user information should not be included during online payment. Anonymity suggests that it is not possible to discover someone’s identity or to monitor an individual's spending patterns.

- **Privacy**

  The proposed system needs to be anonymous as there is no direct information about this payer’s personality associated with it. Therefore, the proposed system must be able to protect privacy, identity and personal information.

- **Usability**

  It should not be a sophisticated or complex task to pay online, payments are to be done in an easy and user-friendly way. The proposed system requires only two fields required which are card serial number and validation code to make payment, comparing to credit card and debit card payment where they require personal information and card expiration date.
➢ **Security**

The proposed system should not include user’s personal information and payment communication must be encrypted to prevent information leakage and sniffing.

➢ **Trust**

Trust refers to the degree of customers’ confidence that their money and personal information will be safe. The proposed system should ensure that there is no leakage of personal information and the amount of money is relatively small compare to existing credit card and debit card to minimize the fraud and exposure risk.

➢ **Eligibility**

Not all potential buyers can obtain credit card and debit card due to credit history limitations, low income or other reasons. The proposed system should allow everyone can own prepaid electronic money card to make online payment for web purchase.

➢ **Efficiency**

The proposed system must be designed to cater for small transactions and the administrative or fixed charges should be small enough, comparing to credit card and debit card where the charges are higher than value of the goods.
4.2.4 Summary of Acceptance of Online Shopping and Electronic Money

In this research, questionnaire forms had been conducted for 100 respondents to determine the acceptance of online shopping and electronic money in Malaysia. But only 63 respondents participate in the survey. Please refer below for the full evaluation of the questionnaire. Please refer to Appendix B for questionnaire form.

![Pie chart showing years of using internet](image)

**Figure 4.3: Years of Using Internet**

Many of the respondents have been using internet more than 4 years and above. Based on the result above, we can easily conclude that Malaysians are well exposed to internet. There is a potential market to encourage more Malaysians to perform online purchase if there are more alternative payment systems which is secure and easier to be introduced to current e-commerce.
Figure 4.4: Online Shopping

Half of the respondents have not performed online shopping before, although the majority of them have been exposed to the internet. This shows that more users are reluctant to perform online purchasing, which might be caused by certain reasons such as security, privacy, fraud issues raised by the current online payment system.

Figure 4.5: Last Online Purchase

Majority of the respondents do not perform online shopping weekly. The majority of them have been performing their last online shopping more than 2 months. This frequency of online purchase can be increased if web-based e-money is introduced, as it will provide the convenience to perform online shopping.
Figure 4.6: Frequent of Online Shopping

Majority of the respondents do not perform online shopping frequently. Most of them are performing online shopping when it is necessary. There is a possibility to increase the wish of Malaysians to perform more online shopping if current issue can be identified and eliminate through proposed payment system.

Figure 4.7: Sufficient Information for Online Shopping

Majority respondents agreed that they can easily get sufficient information when performing online shopping. This mean most of users think online shopping is able to satisfy their purchasing needs.
Majority respondents agreed that they can save times while performing online shopping. If payment system is trustworthy, they will intent to perform more online shopping compare to walk-in to shop for shopping.

Majority of respondents disagreed with the online shopping can provide adequate level of security. They believe that security level is not up to the standard to protect the consumer in term of regularities and legal issues. Hence, there is a need to enhance the security level of payment system.
Figure 4.10: Online Shopping can provide adequate level of privacy

Majority of respondents disagreed with the online shopping can safely protect their privacy. They believe that their sensitive information can be easily leaked out while performing online shopping. Proposed web-based e-money will definitely protect the privacy of customer since it is an anonymous card and do not contain any user’s information.

Figure 4.11: Financial loss risk is low for online shopping

Majority of respondents disagreed with the financial loss risk is low when performing online shopping. They believe that stolen credit card information is easily happened while performing online shopping. Web-based e-money contain lesser amount per card, the risk of loss will be lesser.
Figure 4.12: Online Payment through E-Money is better than credit/debit card

Majority of respondents agreed that the online payment through anonymous prepaid electronic money is better than credit/debit card as privacy and financial loss risk is lower.

Figure 4.13: Prefer enter less information during online payment

Majority of respondents agreed that they prefer to enter lesser information during online payment. E-money only requires entering 2 fields (card number & validation code) whereas credit/debit card require entering more information (e.g. Card number, Name, Card Expiration Date, Validation Code etc).
Majority of respondents disagreed that they will perform online shopping again. This may be due to privacy, financial loss risk and security while performing online shopping.

Majority of the respondents are below age of 30 years old. They are the frequent internet users currently. Half of the respondents are still student and not yet have the ability to obtain a credit card or debit card. Hence, web-based e-money is an alternative way for them to purchase online shopping.
Majority of the respondents are paid below RM 6000 monthly. They are to be likely the online shoppers. Web-based e-money will provide an alternative way to the medium income users which might not have qualify to apply credit/debit card. There is a potential target that web-based e-money will be famous among this range of users.

Below is the summary of the analysis:

Majority of respondents are earning below RM 6000 monthly. They have been using internet more than 4 years. However, half of them have never performs online shopping before. Currently, they believe that the online shopping is not secure, leaking out of their privacy and may cause financial loss due to stolen or credit card / debit card fraud. They strongly agreed with the new payment method of using anonymous prepaid electronic money is better than credit card / debit card. Therefore, with the introduction of electronic money, it will encourage more people to perform online shopping.
4.3 Development Technologies

4.3.1 Database

A database is required to store the data and information. Microsoft SQL Server 2005 has been selected as the database technology. Microsoft SQL Server 2005 has been chosen due to the largest number of third-party, front-end support products worldwide and designed strictly for application development. There are even access modules that let the users query the database from the leading spreadsheet programs.

Furthermore, SQL server is easily integrated with other Microsoft products and providing universal data access. Plus, it has good recovery and distributed transaction support. It is also the record-holder of important benchmark awards for scalability and speed, fully Web-enabled database product and the ability to query across the Internet and beyond the firewall. It is very easy to use with the help of SQL Server’s graphical management tools.
4.3.2 Operating System

Microsoft Windows 2003 Server is chosen as an ideal platform for developing this project due to its compatibility with most of the web development software, competitive price, scalability, robustness and IIS 6.0.

Furthermore, Microsoft Windows 2003 Server gives developers their choice of languages, protocols, user interfaces, and application architecture. And virtually all Windows applications have installation wizards that guide the user through all stages of the installation process, giving the user a chance to configure the application while installing it. Besides, this platform is required if either MS SQL Server or IIS or both are used in this project.

4.3.3 Server

Microsoft Internet Information Server is choosing as a ban-net file and application server because it guarantees the network administrator and application developer the same security, networking and administration functionality as Windows 2003 Server. It also can integrate well with Microsoft Windows Active Directory Services, making it easier to develop and integrate Web-based applications.

IIS has built-in capabilities to help administrator secure Web sites and to develop and deploy server-intensive Web applications. It is also familiar with Windows NT Server tools and functionality.
IIS supports Transactional Active Server Pages (ASP), which link together scripts and components to perform multiple actions. IIS is also integrated with other Microsoft tools such as FrontPage, Microsoft Transaction Server, Microsoft Message Queue, Visual InterDev, various back-end tools, and Site Server.

### 4.3.4 Development Languages

ASP.NET and C#.NET has been chosen as development languages for web-based electronic money. ASP.NET is a programming framework built on the common language runtime that can be used on a server to build powerful Web applications. ASP.NET improves upon that foundation by adding support for several new and exciting features in the areas of developer productivity, administration and management, extensibility, and performance.

Microsoft Visual C# 2005 is a programming language designed for building a wide range of applications that run on the .NET Framework. C# is simple, powerful, type-safe, and object-oriented. With its many innovations, C# enables rapid application development while retaining the expressiveness and elegance of C-style languages. Visual Studio supports Visual C# with a full-featured Code Editor, project templates, designers, code wizards, a powerful and easy-to-use debugger, and other tools. The .NET Framework class library provides access to a wide range of operating system services and other useful, well-designed classes that speed up the development cycle significantly.
4.3.5 Development Tools

Visual Studio is a complete set of development tools for building ASP.NET Web applications, XML Web Services, desktop applications, and mobile applications. Visual Basic, Visual C#, and Visual C++ all use the same integrated development environment (IDE), which enables tool sharing and eases the creation of mixed-language solutions. In addition, these languages use the functionality of the .NET Framework, which provides access to key technologies that simplify the development of ASP Web applications and XML Web Services.

4.4 Chapter Summary

This chapter discusses about the evaluation of the result from questionnaire and requirements analysis, which consists of functional requirements and non-functional requirements. Development technologies also have been explained at the end of this chapter.

For the next chapter, program design, user interface design, database design and expected outcome will be discussed.
CHAPTER FIVE

DESIGN

5.1 Introduction

Design is the first step in the development phase for any engineered product or system. System design sits at the technical kernel of the system development process and is applied regardless of the software process model that is used. It is beginning once software requirements have been analyzed.

System design focuses on the layout for the components that are needed to construct a complete product or system. It is an iterative process through which requirements are translated into a ‘blueprint’ for constructing the system. Initially, the blueprint depicts a holistic view of system.

Each of the elements of the analysis model provides information that is required to create a design model. Using one of a number of design methods, the design step produces the following design:

- Data Design
- Architectural Design
- Interface Design
- Procedural Design
5.2 Design Features Consideration

As per discussed in chapter 4 during analysis on the functional and non-functional requirement, few features need to consider during the design of the system to fulfill the requirement such as anonymity, privacy, usability, security, eligibility and efficiency. Of course the main feature is the functionality of the system where it is able to use as an online payment transaction.

- **Anonymity & Privacy**
  
  Personal information cannot be included during payment transaction.

- **Security**
  
  Personal information cannot be included during payment transaction and payment transaction should be encrypted such as using HTTPS.

- **Usability**
  
  Less field need to enter during payment, only two fields that required to input: e-money serial number and validation code.

- **Eligibility**
  
  Everyone can buy prepaid electronic money card and there is no restriction for them for failing to get the cards provided they have money to purchase the cards. Therefore, the card value should small, starting from RM10 to maximum RM500.

- **Efficiency**
  
  Administrative or fixed fee imposed on merchant should be small and should not surpass the value of the goods.

- **Functionality**
  
  The customer is able to choose web-based e-money to make online payment.
5.3 Data Design

The data design transforms the information domain model created during analysis into the data structures that will be required to implement the software. The data objects and relationships defined in the entity-relationship diagram and the detailed data content depicted in the data dictionary provide the basis for the data design activity.

5.3.1 Entity-relationship Diagram (ERD)

Entity-relationship diagram (ERD) is a graphic means for representing the conceptual structure of a database. ERD depicts relationship between data objects. The ERD is the notation that is used to conduct the data modeling activity.

ERD are used to model the logical structure of data. A rectangle is used to represent an entity. A diamond is used to represent between two entities. Line connecting entities and associated relationships are annotated with cardinality. The lines are not directed, and thus there is directional ambiguity for all nonsymmetrical relationships. Oval is used for represent attributes of either entities or relationship.
Figure 5.1: Entity Relationship Diagram
5.3.2 Data Dictionary

Data dictionary is a repository that contains description of all data objects consumed or produced by the system. It contains the physical structure of actual database design.

This proposed system used Microsoft SQL Server 2005 to construct the database for Web-based e-money solution. The database name for issuer is eMoneyIssuer and it is used to store all information that needed in the issuer system. It has three tables. The database name for partner database is eMoney and is used to store the information on the online bookstore product. It has four tables.

The following are the data requirements for the solution and these data are outlined in their tables respectively. Symbol * is used to represent the primary key of the table. Symbol # is used to represent the foreign key.

Table 5.1: Database structure of Cart Table in eMoney database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CartID</td>
<td>bigint</td>
<td>8</td>
<td>Unique code for Cart</td>
</tr>
<tr>
<td>#UserID</td>
<td>bigint</td>
<td>8</td>
<td>User ID</td>
</tr>
<tr>
<td>#ItemID</td>
<td>bigint</td>
<td>8</td>
<td>Item ID</td>
</tr>
</tbody>
</table>
Table 5.2: Database structure of Item Table in eMoney database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*ItemId</td>
<td>bigint</td>
<td>8</td>
<td>Unique code for Item</td>
</tr>
<tr>
<td>BookTitle</td>
<td>nvarchar</td>
<td>100</td>
<td>Book Title</td>
</tr>
<tr>
<td>Author</td>
<td>nvarchar</td>
<td>100</td>
<td>Author of the book</td>
</tr>
<tr>
<td>ProductMedia</td>
<td>nvarchar</td>
<td>50</td>
<td>Product Media</td>
</tr>
<tr>
<td>ISBN</td>
<td>nvarchar</td>
<td>50</td>
<td>ISBN Number</td>
</tr>
<tr>
<td>MoneyValue</td>
<td>bigint</td>
<td>8</td>
<td>Item’s money value</td>
</tr>
</tbody>
</table>

Table 5.3: Database structure of Serial Card Temp Table in eMoney database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*SerialAddID</td>
<td>bigint</td>
<td>8</td>
<td>Auto-create unique number</td>
</tr>
<tr>
<td>#UserID</td>
<td>bigint</td>
<td>8</td>
<td>User ID</td>
</tr>
<tr>
<td>#SerialNumberID</td>
<td>bigint</td>
<td>8</td>
<td>Serial Number ID</td>
</tr>
<tr>
<td>SerialNumber</td>
<td>bigint</td>
<td>8</td>
<td>Serial Number</td>
</tr>
<tr>
<td>Money Value</td>
<td>bigint</td>
<td>8</td>
<td>Money Value</td>
</tr>
<tr>
<td>Money Value To Pay</td>
<td>bigint</td>
<td>8</td>
<td>Money Value to Pay</td>
</tr>
</tbody>
</table>

Table 5.4: Database structure of Purchase Transaction Table in eMoney database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*TrxPurchaseID</td>
<td>bigint</td>
<td>bigint</td>
<td>Unique code for purchase transaction</td>
</tr>
<tr>
<td>#UserID</td>
<td>bigint</td>
<td>bigint</td>
<td>UserID</td>
</tr>
<tr>
<td>#ItemID</td>
<td>bigint</td>
<td>bigint</td>
<td>Item ID</td>
</tr>
<tr>
<td>DateCreated</td>
<td>datetime</td>
<td>8</td>
<td>Transaction Created Date</td>
</tr>
</tbody>
</table>

Table 5.5: Database structure User List Table in eMoney database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*UserID</td>
<td>bigint</td>
<td>8</td>
<td>Unique code for User</td>
</tr>
<tr>
<td>LoginName</td>
<td>nvarchar</td>
<td>50</td>
<td>User’s Login Name</td>
</tr>
<tr>
<td>Password</td>
<td>nvarchar</td>
<td>100</td>
<td>User’s password</td>
</tr>
<tr>
<td>Name</td>
<td>nvarchar</td>
<td>100</td>
<td>User’s Name</td>
</tr>
<tr>
<td>IsAdmin</td>
<td>int</td>
<td>4</td>
<td>Indicator of admin user</td>
</tr>
</tbody>
</table>
### Table 5.6: Database structure of Partner List Table in eMoneyIssuer database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*PartnerID</td>
<td>bigint</td>
<td>8</td>
<td>Unique code for partner</td>
</tr>
<tr>
<td>Account ID</td>
<td>int</td>
<td>4</td>
<td>Account Number</td>
</tr>
<tr>
<td>Company Name</td>
<td>nvarchar</td>
<td>100</td>
<td>Company Name</td>
</tr>
<tr>
<td>Money Value</td>
<td>bigint</td>
<td>8</td>
<td>Money value own</td>
</tr>
</tbody>
</table>

### Table 5.7: Database structure of Serial Number Table in eMoneyIssuer database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Date Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*SerialNumberID</td>
<td>bigint</td>
<td>8</td>
<td>Auto-generate unique serial ID</td>
</tr>
<tr>
<td>SerialNumber</td>
<td>bigint</td>
<td>8</td>
<td>Auto-generate unique serial number</td>
</tr>
<tr>
<td>ValidateCode</td>
<td>int</td>
<td>4</td>
<td>Validation Code</td>
</tr>
<tr>
<td>MoneyValue</td>
<td>bigint</td>
<td>8</td>
<td>E Money Value</td>
</tr>
<tr>
<td>Status</td>
<td>int</td>
<td>4</td>
<td>0 = Active; 1- Not Active</td>
</tr>
</tbody>
</table>
5.3.3 Physical Database Design

After conceptual design, and create the data dictionary of each table, actual database diagram had been generated from SQL 2005 tools. Figure 5.2 shows the physical database diagram for web-based e-money system.

![Database Diagram](image.png)
5.4 Architectural Design

The primary objective of architectural design is to develop a modular program structure and represent the control relationships between modules. In addition, architectural design melds program structure and data structure, defining interfaces that enable data to flow throughout the program.

The system is structured into a number of principal subsystems in system structuring. A system in itself, a subsystem’s operation does not rely on the services provided by other subsystems. Each subsystem is in turn broken into module and has defined interfaces which are required for communication with other subsystems.

Module decomposition, however, is high-level description of the functions which are to be implemented, the designed then derives low-level accounts on how each component will be organized and related to other component from it.
5.4.1 Structure Chart

Structure chart is used to depict high-level abstraction of a specified system. The use of structure chart is to describe the interaction between independent modules. Major functions from the initial component part of the structure chart, which can be broken into detailed sub-components.

The main system is divided into two major components: e-money issuer and e-money partner.

The system prototype that will be developed is web-based e-money system which will relate to the e-money issuer component and e-money partner.

![Figure 5.3: Structure Chart of Web-based E-Money System](image.png)
5.4.1.1 E-Money Issuer Module

This module allow user to update the partner that using the web-based e-money service.
This module also allow user to create new serial number and list the serial information.
This module will also allow user to view the reports of previous payment, invoice and etc.

Figure 5.4: Structure Chart of E-Money Issuer Module
5.4.1.2 E-Money Partner Module

In the e-money partner module there is two sub modules, administrator module and user module. In administrator module, it allows to create item, create user and list transaction history. In user module, user can shop the item, view the cart, check card remaining value and view the transaction history.

![Structure Chart of User E-Money Partner Module](image-url)

Figure 5.5: Structure Chart of User E-Money Partner Module
5.4.2 Data Flow Diagram

Data Flow Diagram (DFD) is a graphical representation of data movement storage in the system. It depicts the broadest possible overview of the system’s inputs, processes and outputs. Data Flow Diagrams are structured analysis and design tools that allow the analyst to comprehend the system and the subsystems visually as a set of interrelated data flows.

The basic notation used to create a DFD is illustrated in Figure 5.6. A rectangle is used to represent an external entity, that is, a system element (e.g. hardware, a person, and another program) or another system that produces information for transformation by the software or receives information produced by the software. A rounded rectangle represents a process or transform that is applied to data (or control) and changes it in some way. An arrow represents one or more data items or data objects. All arrows on a data flow diagram should be labeled. The unclosed rectangle represents a data store – stored information that is used by the software.
<table>
<thead>
<tr>
<th>Notation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Process" /></td>
<td>A transformer of information (a function) that resides within the bounds of the system to be modeled.</td>
</tr>
<tr>
<td><img src="image" alt="External entity" /></td>
<td>A producer or consumer of information that resides outside the bounds of the system to be modeled.</td>
</tr>
<tr>
<td><img src="image" alt="Data store" /></td>
<td>A repository of data that is to be stored for use by one or more processed; may be as simple as a buffer or queue or as sophisticated as a relational database.</td>
</tr>
<tr>
<td><img src="image" alt="Data object" /></td>
<td>A data object; the arrowhead indicated the direction of data flow.</td>
</tr>
</tbody>
</table>

**Figure 5.6: Basic DFD Notation**
The context diagram is the highest-level diagram in the entire set of DFDs for a system. The most abstract version of the system, it presents only the external view: inputs, outputs, terminators and the general function of the system. It has a very important purpose – to show the limits or boundaries of the system.

Figure 5.7: Context Diagram of E-Money Issuer System
Figure 5.8: Context Diagram of E-Money Partner System
Figure 5.9: Data Flow Diagram of E-Money System
5.4.3 Unified Modeling Language (UML)

The Unified Modeling Language (UML) is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling and other non-software systems. The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects. Using the UML helps project teams communicate, explore potential designs, and validate the architectural design of the software.

5.4.3.1 Class Diagram

Class diagrams are widely used to describe the types of objects in a system and their relationships. Class diagrams model class structure and contents using design elements such as classes, packages and objects. Class diagrams describe three different perspectives when designing a system, conceptual, specification, and implementation. These perspectives become evident as the diagram is created and help solidify the design.

Classes are composed of three things: a name, attributes, and operations.

![Class Diagram Components](image)

**Figure 5.10: Class Diagram Components**
Figure 5.11: Web-based E-Money Class Diagram
5.4.3.2 Sequence Diagram

Sequence diagrams demonstrate the behavior of objects in a use case by describing the objects and the messages they pass. The diagrams are read left to right and descending.

![Sequence Diagram Sample](image)

**Figure 5.12: Sequence Diagram Sample**

Complete sequence diagram can be found in Appendix C, below are two examples of sequence diagrams and the explanation of each diagram.

First sequence diagram is log-on scenario. During logon, user will request logon from the security logon user interface, system will display the logon page to allow user enter login name and password. The information will passed and validated from the user object and if the user information is valid the logon screen will be displayed else error message will prompt out. During validation, system will check whether the user is a administrator or a normal users. If users is admin, admin page will be prompt, else user page will displayed.
Figure 5.13: Web-based E-Money Sequence Diagram: Logon Scenario
Second sequence diagram is check card scenario. During check card, user will request for check card, a check card screen will be displayed. User will enter serial number and validation code. The information will be searched through the serial number object with a validate card function. If the card is valid, the validate screen will successfully displayed else an error message will be prompted out.

**Sequence Diagram: Check Card**

![Sequence Diagram: Check Card](image)

**Figure 5.14: Web-based E-Money Sequence Diagram: Check Card**
5.5 Interface Design

The interface design describes how software communicates within itself, to systems that interoperate with it, and with humans who use it. Interface design focuses on three areas of concern: (1) the design of interface between software modules; (2) the design of interfaces between software and other nonhuman producers and consumers of information; and (3) the design of the interface between a human and the computer.

5.5.1 User Interface Design

User interface design is very important to the usability of an application. Good graphical user interface (GUI) should be intuitive, minimum the need for users to memorize things and at the same time interesting to look at. Approaches to designing the user interface of the web-based e-money system are based on several general principles for user interface design, which are consistency, recoverability, confirmation and verification message, responsiveness and reverse action.

The user interface design considerations are stated as the following:

- Design an effective user interface to enable the users to be effective in accomplishing their task.
- Provide a common and consistent look and feel across the application. The interface should reflect a consistent page font, color, image, background and page layout.

Complete interface design can be found in Appendix G (user manual), below are few examples of the interface design and.
5.5.2 User Interface for E-Money Issuer System

E-money was represented in serial number form. Each serial number means a web-based e-money card which content different amount of e-money value.

User can enter the quantity of serial number to be created and the money type that have been predefined in the system. eg: RM10, RM30, RM50 and RM100.

![Create Serial Number Page](image)

**Figure 5.15: Create Serial Number Page**

User must key in a numeric number in the quantity column and select the money type from the drop down list. Click the “Generate” button to generate the new serial number with the selected value from the money type. The new serial number will be generated in Ringgit Malaysia and e-money value (equivalent to the Ringgit Malaysia selected. For example RM 100 will contain 10,000 e-money values.
5.5.3 User Interface for E-Money Partner System

This is a web-based e-money system, so it will only show the payment page when user select web-based e-money as the payment type from previous page. This page supposes to be the 3\textsuperscript{rd} party gateway but in this prototype, it will only show the concept of the process flow.

![Payment Page Image]

**Figure 5.16: Payment Page**
This page will show the Total e-money value which user need to pay. User need to enter the web-based e-money card serial number and validate code and click the “Add Serial Card” button. When the button is click, it will link to the issuer database to validate the serial number, only valid serial number will be accepted else warning message will be appeared.

If one card (serial number) is not enough to make the payment, this system allows multiple cards per transactions. User can add another prepaid card serial number and check the remaining e-money value that need to pay.

There’s a listing table show at the center of the page where it shows the serial number list and e-money value from the card. User can enter the amount need to pay from the respective serial number or even remove the card from the list.

When the remaining value becomes zero, the previously grayed out button “Complete Purchase” will now allow to be click to complete the payment or user can choose the “Clear Card” button to clear the list and cancel the purchase.
5.6 **Procedural Design**

Procedural design transforms structural elements of the program architecture into a procedural description of software components. Procedural design occurs after data, architectural, and interface designs have been established. In an ideal world, the procedural specification required to define algorithmic details would be stated in a natural language such as English. Using natural language, a set of procedural steps can be written in too many different ways. So, a more constrained mode for representing procedural details is used, such as graphical design notation.

5.6.1 **Flowchart**

Flowchart was once the most widely used graphical representation for procedural design. The flowchart is quite simple pictorially. A box is used to indicate a processing step. A diamond represents a logical condition, and an arrow show the flow of control.

The following is the flow chart of e-money issuer system and e-money partner system.
Figure 5.17: Flow Chart for E-Money Partner System (User Module)
Figure 5.18: Flow Chart for E-Money Partner System (Admin Module)
Figure 5.19: Flow Chart for E-Money Issuer System
5.7 Chapter Summary

The design phase is concerned with detailing the physical implementation of the new system. At this time, hierarchical diagram of system routines is created, input and output is designed, and security measures are incorporated into the design. Few key factors that consider during the design are explained in details at the beginning of the chapter.

System design encompasses four distinct but interrelated activities: data design, architectural design, interface design and procedural design. When each of these design activities has been completed, a comprehensive design models for the system.

The design methods of this project lead to a design model of the system. Data structure is developed, program architecture is established, modules are defined and interfaces are established. This blueprint for implementation forms the basis for all subsequent system development work. The implementation phase will be discussed in next chapter.
CHAPTER SIX
IMPLEMENTATION

6.1 Introduction

In this phase, the system requirements and design model of a system will be converted into a workable product. System implementation includes coding, testing and documenting the system as well as training the end users and system administrators.

6.2 Development Environment

Development environment has certain impact on the development of a system. Using the suitable hardware and software not only help to speed up the system development but also determine the success of the project. The hardware and software tools used to develop the entire system are as below:

6.2.1 Hardware Requirements

The hardware specifications of the two machines for development in this project are:

<table>
<thead>
<tr>
<th>Table 6.1: Server Side Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server</td>
</tr>
<tr>
<td>- Running on Windows 2003 Server, Microsoft SQL 2005 and Internet Information Server 6.0</td>
</tr>
<tr>
<td>- Consist of 1 GB RAM</td>
</tr>
<tr>
<td>- Alongside a Pentium Core Duo Processor and a NIC (Network Interface Card) of Ethernet 10/100/1000 Mbps speed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6.2: Client Side Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
</tr>
<tr>
<td>- Any workstation or server with internet browser (Mozilla or Internet Explorer)</td>
</tr>
</tbody>
</table>
6.2.2 Software Tools / Components Requirements

In the development of web-based e-money system, the software basically consisted of components and tools. The components included all the technology used to support the functionality of the system. Whereas the tools applied are those development applications used to design and develop.

Below is a listing of application / tools categories used for the web-based e-money system project development:

1. Application coding tools
   - Microsoft Visual Studio
     - Create coding
     - Ease the task of creating and editing the web page interface design.
   - Microsoft Internet Information Server 6.0
     - Maps local directory to virtual directory.
     - Creates local web site.

2. Database Implementation Tools
   - SQL 2005 Management Studio
     - Creates database table, view and edit tables.
     - View relationships between the tables.
     - View and edit data in database tables using SQL statements.
6.3 Installations and Setups

Server and development tools installations are the very first step before starting off with any development work. When using Microsoft’s products, it is essential to know the sequence of products installations to ensure smooth execution without system errors.

Below is the sequence of the installation process on the server:

1. Windows 2003 Server
2. Microsoft SQL 2005
3. Microsoft Visual Studio

6.3.1 Create Virtual Server

IIS 6.0 provides a feature that allows web content to be organized, by using virtual servers. All the ASP files, and other relevant files, have to be stored in a directory that is mapped to the server. The following are steps to create virtual servers.

1. Start Windows Explorer and create 2 new physical directory named EMoney and EMoneyIssuer, under the \Inetpub\wwwroot directory created by IIS on your hard drive.
2. Copy all the EMoney and EMoneyIssuer files to this directory
3. Then, click Start, point to Programs, point to Administrative Tools, and then click Internet Information Service.
4. Expand `<domain name>` by clicking +. Right click on Default Web Sites and point to New, select Virtual Directory. You will see the splash screen of the Virtual Directory Creation Wizards. Click on [Next].

5. Type EMoney in the Alias text box; then click on [Next].

6. On the next screen, click [Browse] button and select the directory `\Inetpub\wwwroot\EMoney` that you have created in step 1. Then, click [Next].

7. Make sure that the Read and Run scripts checkboxes are checked, and that the Execute checkbox is empty. Click on [Next] and then, click on [Finish].

8. Repeat step 4 to step 7 for EMoneyIssuer virtual directory.

9. The EMoney & EMoneyIssuer virtual directory will appear on the tree in the IIS Administration Windows

10. Right click on the EMoney Virtual Directory and select Properties

11. You will notice that you have created an application called EMoney – the same as the virtual directory. If the box next to the application name is blank, you need to hit the [Create] which will turn into [Remove]. This is to enable us to use Global.asa in the scripts.

12. Check only the Read checkbox.

13. Exit IIS.
6.3.2 Create Database

There are several ways to create a new database. It can be done either using the SQL Server 2005 Management Studio. Management Studio is an easier mean of creating a database since it let the user to create a database through a user-friendly interface and no SQL scripting is required.

Here is a summation of steps required to create a database using SQL Server 2005 Management Studio:

1. Make sure Microsoft SQL Server 2005 is installed and the SQL Server service is started.

2. Click Start, point to Programs, point to Microsoft SQL Server 2005, and then click Microsoft SQL Management Studio.

3. Click [Connect] after enter the Server name.

4. Expand <server name> by clicking +. Right click on Databases and click on New Database. You will see window to create New Database.

5. Enter EMoney into the Database Name and check the path to store the database file.

6. Repeat step 4 and step 5 to create EMoneyIssuer database.

7. Run the script to create the table and store procedure for both databases.

8. Expand <server name> by clicking +, expand Security and expand Login. Then right click on sa and select Properties. Enter a strong password and click [OK].

6.3.3 ASP.NET

ASP.NET provides a configuration system we can use to keep our applications flexible at runtime. The `<appSettings>` element of a web.config file is a place to store connection strings, server names, file paths, and other miscellaneous settings needed by an application to perform work. The items inside appSettings are items that need to be configurable depending upon the environment, for instance, any database connection strings will change as you move your application from a testing and staging server into production.

➢ Connection

The Connection object contains all of the details about a specific connection to a data store, such as data store name, user name, database name, etc. What we supply as part of these connection details varies with the provider.

This is the example coding:

```xml
<configuration>
  <appSettings>
    <!-- Database Type -->
    <!-- microsoftsqlserver -->
    <!-- oledbsupported -->
    <!-- odbc unsupported -->
    <!-- oracledatabase -->
    <add key = "DatabaseType" value = "microsoftsqlserver"/>

    <!-- Connection String -->
    <add key = "EComConnectionString" value = "Data Source=TAKUMI;Initial Catalog=eMoney;User Id=sa;Password=p@$w0rd;"/>
    <add key = "IssuerConnectionString" value = "Data Source=TAKUMI;Initial Catalog=eMoneyIssuer;User Id=sa;Password=p@$w0rd;"/>
  </appSettings>
</configuration>
```
To read the key we use the ConfigurationSettings class from the System.Configuration namespace, as shown below.

```csharp
private void Page_Load(object sender, EventArgs e)
{
    string connectionInfo = ConfigurationSettings.AppSettings["ConnectionInfo"];
    using (SqlConnection connection = new SqlConnection(connectionInfo))
    {
        connection.Open();
        // perform work with connection
    }
}
```

➢ **Record**

To retrieve database record below code is being used:

For example:

```csharp
public System.Data.DataTable GetUserCart(int userId)
{
    System.Data.DataTable dt;
    this.DataAccess.DataAccessParameter.Add("@UserId", userId,
    System.Data.DbType.Int32);
    dt = this.DataAccess.ExecuteDataTable("p_GetUserCart",
    System.Data.CommandType.StoredProcedure);
    return dt;
}
```
6.3.4 Using Built-in ASP.NET Objects

We can make calls to one or several of the ASP.Net intrinsic objects to create the dynamic element of an active server page. These objects are immediately accessible to the ASP.Net developer and neatly cover all the key aspects of creating dynamic and interactive pages. Together, the five intrinsic and their parent object form the hierarchy that is the ASP.Net Object Model, which looks something like this:

![ASP.NET Object Model Diagram]

Figure 6.1: ASP.NET Object Model

Each of the objects has a set of collections, methods, properties and events which provide them with all their functionality.

- **Application Object**

  The Application object represents information that can be shared among all users of an Active Server Pages .NET Application.
- **Request Object**
  
  The Request object represents all information sent from a browser to a server including from variables and query strings. Below are example of Request object coding in my project:

  ```
  flag = Request.QueryString("flag")
  ```

- **Response Object**
  
  The Response object represents all information sent from a server to a browser including HTML content sent by an ASP.NET page. Example of Response object in my project:

  ```
  ```

- **Server Object**
  
  The Server object enables the use of various utility functions on the server. Below is the example of the coding:

  ```
  set obj=Server.CreateObject("Investigation.class1")
  ```

- **Session Object**
  
  The Session object represents information about a particular user session.

  ```
  if (Session["UserId"] == null)
  ```
6.3.5 Create Active Server Pages .NET (ASP.NET)

An ASP.NET page is any file located on your Web server that has the extension .ASPX. This special extension distinguishes an ASP.NET page from a normal HTML file that ends with the extension .HTML or .HTM. Active Server Pages include server-side script. By default, C#.Net is the chose language for scripting ASP.NET in my project. But it is still perfectly legal to mix languages, as long as they are properly specified for each section of code in the application’s page (web page).

Coding below is used to define the basis handling instruction for the rest of the project:

```html
<compilation
defaultLanguage="c#"
debug="true"/>
```

A normal HTML page contains static content. Every time an HTML page is requested, the content displayed by the page remains the same. An ASP.NET page, on the other hand, can contain content that changes whenever the page is requested.

For example:

```html
<TD>
  <TABLE id="Table4" borderColor="#ffcccc" cellSpacing="0" cellPadding="0" border="1">
    <TR>
      <TD align="center" width="120"><IMG height="22" src="Images/Money.jpg">&nbsp;
        <asp:label id="Label5" runat="server" Font-Size="Larger" Font-Names="Comic Sans MS" EnableViewState="False" Font-Bold="True">19346</asp:label></TD>
    </TR>
  </TABLE>
</TD>
```

6.3.6 Security Management

Security measures the features of an information system that prohibit accidental or deliberate misuse of data; examples include backup procedures, password protection, and audit trails.

The new on-line, user-friendly system creates an additional security burden; unauthorized users can learn to use and abuse them just as quickly as authorized personnel can. The fact that each update takes place immediately, rather than large, closely monitored bath job, also means that it is easier to hide any tampering.

System security must guard against both errors and computer crime. Actually, there is some overlap between these two areas, since the methods used to recover from errors can also help in recovering from computer crimes.

The crimes that are committed using computer equipment are not new ones; they includes such as acts as embezzlement, theft of information, and sabotage. The most widely used technique is to require the input of a valid password in order to gain entry to the system. In the web-based e-money system, there are several levels of users that had mentioned before. So, different password allows different levels of access; for instances, an admin is allowed to view history for a user but not allowing to edit the information of a user details.
6.4 Chapter Summary

This chapter discusses about how the system is developed and translate from the design phase. Overall the primary goal of this phase is to produce a simple, clear source code with internal documentation that will ease the processes of verification, debugging, testing, modification and further enhancement.

The next chapter will discuss in the testing phase which will describe how the system is tested to make sure it is function due to the requirement and specification that had discuss.
CHAPTER SEVEN
TESTING AND EVALUATION

7.1 Introduction

Testing is a critical element in uncovering logical error and to test the system reliability. The goal is to design tests that will uncover the greatest number of errors or classes of errors with the minimum amount of time and effort.

In developing a system, testing usually involves several stages. First, each program component is tested on its own, isolated from the other components in the system. Such testing is known as unit/module testing.

The primary goal of unit testing is to confirm that the unit is correctly coded and that it carries out the functions it is supposed to carry out. This stage of testing verifies that the component functions properly with the types of input and output expected from studying the component’s design. After each component has been tested, the interaction between these components must be tested again to ensure that the components can be integrated.

When the individual components are working correctly and meet the objectives, these components are combined into a working system. Integration testing is done on the groups of integrated modules to verify that the system components work together as described in the system and program design specifications.
System testing is the final testing procedure. A system test is a series of different tests designed to fully exercise the system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets specified requirements. System testing takes place at a higher level, the testing focuses on behavior rather than function or functional structure.

System evaluation is implemented by more than simply comparing the information obtained with the information which is expected. It is also related to the user environment, attitudes, information principles and several other matters which must be given consideration before the actually efficacy can be concluded.

At all phases of the system approaches, evaluation is a process that occurs continuously, drawing on a variety of sources and information.

The role of this evaluation phase was to determine:

- The extent to which the expected outcomes have been realized,
- The prescriptive value of the process where extraneous factors were taken consideration.
7.2 Testing Stages

There are several testing stages that needed to carry out to complete a system testing phase, there are listed below.

7.2.1 Unit Testing

For unit testing, coding and testing are carried out in parallel. The primary goal of unit testing is to confirm that the unit is correctly coded and that it carries out the functions it is supposed to carry out. The unit testing technique was also used to ensure that the bugs are fixed without side effects. Functions and procedures in each module are examined carefully for error after coding.

7.2.1.1 White-Box Testing

White-box testing, sometimes called glass-box testing is a test case design method that uses the control structures of the procedural design to derive test cases. Using white-box testing methods, the software engineer can derive test cases that:

- Guarantee that all independent paths within a module have been exercised at least one;
- Exercise all logical decisions on their true and false sides;
- Execute all loops at their boundaries and within their operational bounds;
- Exercise internal data structures to assure their validity.
Below are the reasons why white-box testing should carry out:

- Logic errors and incorrect assumptions are inversely proportional to the probability that a program path will be executed. Errors tend to creep into our work when we design and implement function, conditions, or control that are out of the mainstream. Everyday processing tends to be well understood (and well scrutinized), while “special case” processing tends to fall into the cracks.
- We often believe that a logical path is not likely to be executed when, in fact, it may be executed on regular bases. The logical flow of a program is sometimes counterintuitive, meaning that our unconscious assumptions about flow of control and data may lead us to make design errors that are uncovered only once path testing commences.
- Typographical errors are random. When a program is translated into programming language source code, it is likely that some typing errors will occur. Many will be uncovered by syntax checking mechanisms, but others will go undetected until testing begins, it is as likely that a typo will exist on as obscure logical path as on a mainstream path.

7.2.1.2 Black-Box Testing

Black-box testing focuses on the functional requirements of the software. That is, black-box testing enables the software engineer to derive sets of input conditions that will fully exercise all functional requirements for a program. Black-box testing is not an alternative to white-box techniques. Rather, it is a complementary approach that is likely to uncover a different class of errors than white-box methods.
Black-box testing attempts to find errors in the following categories:

- Incorrect or missing functions
- Interface errors
- Errors in data structures or external data base access
- Performance errors
- Initialization and termination errors

Unlike white-box testing, which is performed early in the testing process, blank-box testing tends to be applied during later stages of testing. Because black-box testing purposely disregards control structure, attention is focused on the information domain.

### 7.2.1.3 Data Structure-based Testing

The development of data structure-base tests involves looking at the data structures used by the module with an eye towards errors that might be related to the structure being used.

For example, if an array or linked list of values is manipulated by the module that being tested, for test cases should be designed to properly exercise the module:

- Zero elements (an empty array or list)
- Exactly one element.
- One less that the maximum number of elements in an array or list as given in specification
- Maximum number of elements in an array or list
7.2.2 Integration Testing

After performing the unit testing, the modules are integrated or combined into a working system. During the integration, the testing was carried out in order to identified the fault and failure caused by the integration.

The integration testing includes structure tests and functional tests. Structure tests emphasis is on exercising all input and output parameters of each module, and exercising all modules and all calls, including calls to utility routines. For example, the code block for menu bar on each module is integrated into only one procedure that can be called by all the modules. This will eliminate redundant codes and make the coding simpler.

For functional tests, the goal is to demonstrate that all functions specified for the system in the requirements and specification documents are operational.

During the integration, all the modules were combined and tested in a testing environment. The testing environment was consistent for all the modules in terms of interface and function calling procedures. The program flow of the modules were reviewed and identified. Finally the program flow for the entire program were reviewed and tested with some test cases.
7.2.3 System Testing

The next testing procedure is the system testing. System testing is performed to find out errors, which result from unanticipated interactions of system components or units. The testing process is also concerned with validating the system to meet its functional and non-functional requirements.

7.2.4 Acceptance Testing

This is the final stage in the testing process before the system is accepted for operational use. This testing test was merely test the acceptance of the user towards the interfaces. After this testing stage, the interfaces design was improved to fulfill the user needs.

7.3 Test Case

A test case in software engineering is a set of conditions or variables under which a tester will determine if a requirement or use case upon an application is partially or fully satisfied. It may take many test cases to determine that a requirement is fully satisfied. Below is the test cases that had been used to test the e-money issuer and e-money partner system during system testing phase. Complete test case can be found in Appendix D. Below is two examples of test case and the explanation.
7.3.1 Test Cases for E-money Issuer System

Below is one of the examples of test case for e-money issuer system.

Table 7.1: Test Case for Partner Listing and Payment Page with Invalid Amount

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Partner Listing and Payment Page with Invalid Amount</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Partner List had been created; Current e-money value = 2000</td>
</tr>
<tr>
<td>Test Data:</td>
<td>Cheque Number=123456; Payment Amount=9999</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Expand “E-money Maintenance” at the left pane  
2. Select “E-money Partner” in the tree view  
3. E-money partner list will display  
4. Choose a company name, check the e-money value for the chose company  
5. Click on [Pay] button of the beside the company  
6. “E-money Partner Payment” page will show  
7. Company Name and current e-money will be display same as the main page  
8. Enter Cheque Number and Payment Amount  
9. Click on [Pay] button |
| Expected Result: | The value of the amount is not able to deducted because Payment Amount>Current e-money Value |
| Pass/Failed:  | |
7.3.2 Test Cases for E-money Partner System

Below is one of the examples of test case for e-money partner system.

Table 7.2: Test Case for Payment Page with Two Valid Serial Numbers

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Payment Page with Two Serial Number</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Shopping Item had been selected into Cart and Serial Number had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>Serial Number = 766228765, Validate Code=765, Serial Number = 683613990, Validate Code=682</td>
</tr>
</tbody>
</table>
| Steps:       | 1. From “My Cart” page, select payment drop down list, select “E-money” as payment type  
               2. Click [Continue Payment] button and payment page will show  
               3. Enter Serial Number and Validate code  
               4. Click [Add Serial Card] button  
               5. Check on the “Remaining” value  
               6. Add 2nd Serial Number and Validate Code  
               7. Click [Add Serial Card] button  
               8. Check on the “Remaining” value  
               9. Adjust the “Amount to Pay” column to made the remaining value become zero  
               10. Click [Complete Purchase] button |
| Expected Result: | Remaining value need to be calculated correctly and payment should be proceed successfully |
| Pass/Failed:   | |

This is a test case to test payment page with two valid serial numbers. As a prerequisite, the shopping items had been selected into the shopping card the serial number had been created. The test data will be two valid serial numbers and their validation code. The steps of the test case are: select “E-money” as payment type from the drop down list in “My Card” page. Then click “Continue Payment” button and enter the serial number and validate code in the payment page. Next, click on the “Add Serial Card” button to add the second serial number and validate code. Adjust the “Amount to Pay” to zero and click “Complete Purchase” button. The expected result will be the remaining value need to be calculated correctly and payment should be proceeding successfully.
7.4 Evaluation Objectives

The objectives of this evaluation can be seen in its effort to tackle the following important areas of the web-based e-money:

1. To measure anonymity, usability, security, trust, eligibility, efficiency and privacy of the system so that the evaluation will resolve the issues identified.
2. To measure the functionalities of the system

7.5 Evaluation Methodology

The method of this evaluation chose 25 online consumers, which used to perform online transaction by using credit card and 25 online merchant owners that currently offer online shopping web sites. The aim is to get their response and perception towards the questionnaire which is provided in Appendix E. The next section illustrates the evaluation results.

7.6 Evaluation Result

There are two evaluation forms, first one is for online consumers and second one is for online merchants. All the information gathered via questionnaires are analyzed and presented in the following sections:

7.6.1 Evaluation of Web-based E-Money System for Online Consumers

The questionnaires are presented to 25 online consumers which have been performing online shopping. There are ten questions with three answers to each question where the participants have to choose one answer per question. The result of each question is done by summing the total answers of that question.
Below is the feedback of the evaluation result from consumer’s perspective on web-based electronic money:

- **Anonymity** – 90 percent users agreed that e-money is an anonymous payment system since it does not carry any user information.
- **Usability** – 80 percent users believed that this payment method is very easy to use since they are only require to key in only 2 fields which are serial card number and validation code to make payment.
- **Security** – 60 percent of users agreed that e-money is more secure compare to credit card since there are many reported frauds on credit card system.
- **Trust** – 70 percent of users trust e-money is a better alternative payment method since this is a new online payment alternative.
- **Eligibility** – 80 percent users agreed it is easier to purchase e-money since there is no restriction of not getting the prepaid electronic money as long you have money to buy the card.
- **Efficiency** – 70 percent of users agreed that e-money is more appropriate to use for small amount online transaction since the limit of the card is so small.
- **Privacy** – 90 percent of users agreed that e-money did not content personal information, hence it protect users privacy.
- **Functionality** – 70 percent of users agreed that web-based e-money can be used for online payment transaction.
- **Acceptability** – More than 60 percent of users would buy the e-money to make online payment and introduce this payment method to their friends.
Table 7.3: Summary of Web-based E-Money Evaluation Form for Online Consumer

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Question</th>
<th>Yes</th>
<th>No Comment</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anonymity</td>
<td>Do you agree e-money is an anonymous payment system?</td>
<td>23</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Usability</td>
<td>Do you think e-money is easy to use?</td>
<td>20</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Security</td>
<td>Do you think e-money is more secure compare to credit card?</td>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Trust</td>
<td>Do you trust e-money is a better alternative payment method for online purchasing?</td>
<td>18</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Eligibility</td>
<td>Do you think it is easier to purchase e-money compare to apply credit card?</td>
<td>20</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Efficiency</td>
<td>Do you think e-money is more appropriate to use for small amount online transaction compare to credit card?</td>
<td>18</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Privacy</td>
<td>Do you agree e-money did not content personal information, hence it protect users privacy?</td>
<td>22</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Functionality</td>
<td>Do you think e-money able to make payment for online transaction?</td>
<td>18</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Acceptability</td>
<td>Will you buy e-money to perform online purchase?</td>
<td>18</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Acceptability</td>
<td>Will you introduce e-money to your friend?</td>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 7.1: Evaluation Result for Online Consumers
7.6.2 Evaluation of Web-based E-Money System for Online Merchants

The second questionnaires are presented to 25 online merchants who are using credit card as one of their online payment method. There are ten questions with three answers to each question where the participants have to choose one answer per question. The result of each question is done by summing the total answers of that question.

Below is the feedback of the evaluation result from merchant’s perspective on web-based electronic money:

- **Anonymity** – 80 percent merchants agreed that e-money is an anonymous payment system since it does not carry any user information.
- **Usability** – 80 percent merchants believed that the payment method is very easy to use as the online consumer require to key in only 2 fields which are serial card number and validation code to make online payment.
- **Security** – 70 percent of merchants agreed that e-money is more secure compare to credit card since there are many reported frauds on credit card system.
- **Trust** – 70 percent of merchants trust e-money is a better alternative payment method since this is a new online payment alternative
- **Eligibility** – 70 percent merchants agreed that it is easier for them to implement this system since many online consumers can easily get the e-money card to make online payment.
- **Efficiency** – 75 percent of merchants agreed that e-money is more appropriate to use for small amount online transaction compare to credit card since administrative and charges fee are small.
- **Privacy** – 90 percent of merchants agreed that e-money did not content personal information, hence it protect users privacy

- **Functionality** – 80 percent of merchants agreed that they can implement web-based e-money for another alternative online payment method.

- **Acceptability** – More than 60 percent of merchants agreed to implement e-money as another alternative online payment method and would introduce this payment method to other merchants.

**Table 7.4: Summary of Web-based E-Money Evaluation Form for Online Merchants**

<table>
<thead>
<tr>
<th>No</th>
<th>Feature</th>
<th>Question</th>
<th>Yes</th>
<th>No Comment</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anonymity</td>
<td>Do you agree e-money is an anonymous payment system?</td>
<td>20</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Usability</td>
<td>Do you think e-money is easy to use?</td>
<td>20</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Security</td>
<td>Do you think e-money is more secure compare to credit card?</td>
<td>18</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Trust</td>
<td>Do you trust e-money is a better alternative payment method for online purchasing?</td>
<td>17</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Eligibility</td>
<td>Do you think it is easier for user to purchase e-money compare to apply credit card?</td>
<td>18</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Efficiency</td>
<td>Do you think e-money is more appropriate to use for small amount online transaction compare to credit card?</td>
<td>19</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Privacy</td>
<td>Do you agree e-money did not content personal information, hence it protect users privacy?</td>
<td>23</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Functionality</td>
<td>Do you think e-money able to make payment for online transaction?</td>
<td>20</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Acceptability</td>
<td>Do you want to implement e-money as another payment method?</td>
<td>18</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Acceptability</td>
<td>Will you introduce e-money to others merchant?</td>
<td>16</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
7.6.3 Evaluation Result Summary

Based on the evaluation results, the proposed web-based electronic money achieves the objectives because it helps to solve anonymity, privacy, trust, efficiency, usability, eligibility, security and acceptability issues comparing to existing conventional payment method which are credit card and debit card. Majority of the respondents either from online consumers and merchants agreed that web-based e-money is a better alternative online payment method. Hence, the development of web-based e-money in Malaysia should be encouraged as there is a potential market for web-based e-money.
7.7 Chapter Summary

This chapter describes the testing stages that had been carried out for the project. Test cases are used to perform the testing. Generally, the main objectives of the project as described earlier have been achieved.

This chapter also discusses about the system evaluation and review process the system to solve issues identified from conventional payment system such as anonymity, usability, security, trust, eligibility, efficiency and privacy. The methodology adopted in conducting this evaluation was clearly mentioned at the beginning of the chapter. The results of the evaluation revealed that the development of web-based e-money system is encouraging and can help to achieve the objectives. The details of such achievement was presented in tables and figures disclosed in the chapter.
CHAPTER EIGHT

CONCLUSION

8.1 Introduction

This chapter will provide the summary of the research, discussion on the achievement of research objectives and research contribution. Future work is being discussed in this chapter as well.

8.2 Research Summary

This research presented the advantages of web-based electronic money and compared it with online credit cards and debit cards. The main advantage of web-based electronic money is anonymity where people can use it in cyberspace to make online purchase. Their purchases will not be recorded and linked to personal profile. Conventional money (such as coins and bank notes) offers this advantage, but do not allow buying over Internet. Credit cards allow the online buying, but the seller obtains users information (including the credit card number) during the transaction. With electronic money in used, users will stay anonymous even if they do shopping over Internet. Although many of Malaysian still feels uncomfortable of making purchase through the internet, the introduction of electronic money will indeed solve the worries in term of foremost of privacy, security issue and as well as trust, efficiency, usability, eligibility and acceptability issues.
8.3 Achievement of Research Objectives

This research was succeeded in achieving the objectives set out for it. It solves the anonymity, privacy, trust, efficiency, usability, eligibility and security concern compare to existing conventional payment method. The web-based electronic money system is an alternative online payment system that can be positively used by consumers and merchants.

Table below provides the comparison between proposed web-based e-money with current online payment system show the achievement of the research objectives.

Table 8.1: Comparison between Proposed Web-based E-money with Current Online Payment System

<table>
<thead>
<tr>
<th></th>
<th>Proposed Web-based Electronic Money</th>
<th>Online Credit Card Payment</th>
<th>Debit Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Payment Time</td>
<td>Prepaid</td>
<td>Postpaid</td>
<td>Prepaid</td>
</tr>
<tr>
<td>Transaction information transfer</td>
<td>Free transfer. No need to leave the name of parties involved</td>
<td>The store and bank checks the status of the credit card</td>
<td>The store and bank checks the status of the debit card</td>
</tr>
<tr>
<td>Online and offline transactions</td>
<td>Online transactions</td>
<td>Online transactions</td>
<td>Online transactions</td>
</tr>
<tr>
<td>Bank account involvement</td>
<td>No involvement</td>
<td>Credit card account makes the payment</td>
<td>Debit card account makes the payment</td>
</tr>
<tr>
<td>Users</td>
<td>Anyone</td>
<td>Any legitimate credit card users</td>
<td>Any legitimate debit card users</td>
</tr>
<tr>
<td>Party to which payment is made out</td>
<td>Store</td>
<td>Distributing Bank</td>
<td>Store</td>
</tr>
<tr>
<td>Consumer’s transaction risk</td>
<td>Consumer is at risk of the electronic cash getting stolen, lost, or misused.</td>
<td>Most of the risk is borne by the distributing bank, consumers only have to bear part of the risk</td>
<td>Consumer is at risk of the debit card getting stolen, lost, or misused.</td>
</tr>
</tbody>
</table>
Table 8.1, continued

<table>
<thead>
<tr>
<th>Current degree of popularity</th>
<th>Unable to meet financial internet standards in the areas of expansion potential and internationalism</th>
<th>Credit card organizations check for certification then total the purchases. Therefore it can be used internationally, and is the most popular payment type</th>
<th>Debit card organizations check for certification then total the purchases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anonymity</td>
<td>Entirely anonymous</td>
<td>Partially anonymous</td>
<td>Partially anonymous</td>
</tr>
<tr>
<td>Usability</td>
<td>Lesser information needed to be provided</td>
<td>Require a lot of information to determine actual buyer.</td>
<td>Require a lot of information to determine actual buyer.</td>
</tr>
<tr>
<td>Small payments</td>
<td>Transaction costs are low, suitable for small payments</td>
<td>Transaction costs are high. Not suitable for small payments.</td>
<td>Transaction costs are high. Not suitable for small payments.</td>
</tr>
<tr>
<td>Database safeguarding</td>
<td>Needs to safeguard a large database, and maintain records of the serial numbers of used electronic cash.</td>
<td>Safeguards regular credit card account information.</td>
<td>Safeguards regular debit card account information.</td>
</tr>
<tr>
<td>Transaction information face value</td>
<td>Face value is often set, and cannot give change</td>
<td>Can be signed and issued freely in compliance with the limit.</td>
<td>Can be deducted freely in compliance with the limit.</td>
</tr>
<tr>
<td>Limit on transfer amounts</td>
<td>Dependant on how much is prepaid</td>
<td>Dependent on the limit of the credit card</td>
<td>Dependant on how much money is saved.</td>
</tr>
</tbody>
</table>
8.4 Research Contributions

The results of this study indicates that alternative payment mechanisms such as web-based e-money have potentials for displacing currency in circulation both in the long run and in the short run. The results generally indicate signs which are clearly paving the way for Malaysian to purchase online provided the necessary infrastructure and support services are established by the issuers of these web-based e-money initiatives to create value to the customers and hence propagate the usage these initiative. As a conclusion, web-based electronic-money has a potential market in Malaysia as the acceptance degree by consumer and merchants is very high.

8.5 Future Work

This research attempted to embrace a wide spectrum of possible issues with acceptance of web-based Electronic-money in Malaysia. Future research may focus on the further development and validation of the concept of user acceptance of web-based e-money. For instance a model of user acceptance of web-based e-money may be developed and validated to become a reliable tool for gauging user acceptance of electronic payment systems and similar related technology. Future work can be concentrated on the validation of specific factors that can influence user acceptance. It can concern itself solely with just one of the issues, e.g. privacy, trust or security, usability.

Of course, the most natural continuation of this research would be to take the design recommendations even further. They can be further validated, enhanced and substantiated in the context of actual use or in larger scale experiments. It would be an interesting long
term study to observe the effect of the design recommendations in a real life system on the market, to observe their relevance in a longer span of time, and to track down their development. A secure third party payment gateway can be designed to link up between issuer and partner (merchant) to provide a complete set of electronic money system.

A promising direction of future research is developing a system for evaluation of web-based e-money. This direction presumes creating evaluation models, methods, tools and techniques, etc. For instance, heuristic evaluations or checklists can be created for revealing problems with web-based e-money at the design stage, paving the way for improvements and changes in the current and future systems. These evaluation methods and tools can be then validated empirically. In conclusion, future research has a great number of exciting opportunities. It can transcend the field of web-based e-money and delve into other areas of e-commerce and future information technology.
REFERENCES


European Central Bank (2002). E-payments In Europe – The Eurosystem’s Perspective


Shanmugam, Bala; Nair, Mahendhiran; Kuppasamy, M. (2002). *A case study: electronic money in Malaysia: e-money and smart card technology have a patchy record so far in developed countries, but their progress in Malaysia is especially promising*. (Electronic Money). *Journal of Banking and Financial Services*.


# APPENDIX A: USE CASE SPECIFICATION

## 1. Use Case Specification: Logon

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>administrator and users.</td>
<td>System → Passive (Validate login).</td>
</tr>
</tbody>
</table>

**Brief Description**

This use case allows all participants to login.

**Activation Condition(s)**

Upon Request.

**Pre-Condition(s)**

User administrator should have an account in order to login to the system.

**Flow of Event(s)**

1. This use case starts when agent login.
2. A participant logs out.
3. Use case ends.

## 2. Use Case Specification: View Item

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>users.</td>
<td>System → Passive (Retrieve Item information from database).</td>
</tr>
</tbody>
</table>

**Brief Description**

This use case allows users to view item.

**Activation Condition(s)**

Upon Request.

**Pre-Condition(s)**

Item had been created by administrator.

**Flow of Event(s)**

1. This use case starts when user request to view item
2. The system display item list
3. Use case ends.
3. Use Case Specification: Shopping Cart

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary : users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary : System ( \rightarrow ) Passive (Add item and sum price total).</td>
</tr>
<tr>
<td>Brief Description</td>
<td>This use case allows users to perform online shopping</td>
</tr>
<tr>
<td>Activation Condition(s)</td>
<td>Upon Request.</td>
</tr>
<tr>
<td>Pre-Condition(s)</td>
<td>Item had been created by administrator</td>
</tr>
<tr>
<td>Flow of Event(s)</td>
<td>1. This use case starts when user add item to shopping cart</td>
</tr>
<tr>
<td></td>
<td>2. Price of item being added into total</td>
</tr>
<tr>
<td></td>
<td>3. User continue make payment or quit</td>
</tr>
<tr>
<td></td>
<td>4. User case end.</td>
</tr>
<tr>
<td>Extended Use Case</td>
<td>Make Payment</td>
</tr>
</tbody>
</table>

4. Use Case Specification: Make Payment

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary : users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary : System ( \rightarrow ) Passive (Validate card).</td>
</tr>
<tr>
<td>Brief Description</td>
<td>This use case allows users to make payment</td>
</tr>
<tr>
<td>Activation Condition(s)</td>
<td>Upon request</td>
</tr>
<tr>
<td>Pre-Condition(s)</td>
<td>Item had been added by user into shopping cart</td>
</tr>
<tr>
<td>Flow of Event(s)</td>
<td>1. This use case starts when user click payment</td>
</tr>
<tr>
<td></td>
<td>2. User select payment type</td>
</tr>
<tr>
<td></td>
<td>3. User enter card’s serial number</td>
</tr>
<tr>
<td></td>
<td>4. System validate card’s serial number and continue payment</td>
</tr>
<tr>
<td></td>
<td>5. Use case end.</td>
</tr>
</tbody>
</table>
5. Use Case Specification: Check Card

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary</th>
<th>users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
<td>System → Passive (Retrieve card balance from database).</td>
</tr>
</tbody>
</table>

**Brief Description**
This use case allows users to check card balance

**Activation Condition(s)**
Upon request

**Pre-Condition(s)**
Card serial number been created in database

**Flow of Event(s)**
1. This use case starts when user check card balance
2. User enter serial number
4. Use case end.

6. Use Case Specification: View History

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary</th>
<th>users and administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
<td>System → Passive (Display transaction history).</td>
</tr>
</tbody>
</table>

**Brief Description**
This use case allows users or administrator to view transaction history

**Activation Condition(s)**
Upon request

**Pre-Condition(s)**
Transaction had been done previously

**Flow of Event(s)**
1. This use case starts when users/administrator view transaction history
2. System display transaction history
3. Use case end.
7. Use Case Specification: Create Item

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary : administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary : System → Passive (Save item to database).</td>
</tr>
</tbody>
</table>

**Brief Description**
This use case allows administrator to create item

**Activation Condition(s)**
Upon request

**Pre-Condition(s)**
User has administrator rights

**Flow of Event(s)**
1. This use case starts when administrator add new item
2. Item information save into system
3. Use case end.

8. Use Case Specification: Create User

<table>
<thead>
<tr>
<th>Actor(s)</th>
<th>Primary : administrator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary : System → Passive (Save user to database).</td>
</tr>
</tbody>
</table>

**Brief Description**
This use case allows administrator to create user

**Activation Condition(s)**
Upon request

**Pre-Condition(s)**
User has administrator rights

**Flow of Event(s)**
1. This use case starts when administrator add new user
2. System validate user information, avoid duplicate information
3. User information save into system
4. Use case end.
9. Use Case Specification: Create Serial Number

| Actor(s)      | Primary     : administrator  
|               | Secondary   : System → Passive (Save serial number to database). |
| Brief Description | This use case allows administrator to create serial number |
| Activation Condition(s) | Upon request |
| Pre-Condition(s) | User has administrator rights |
| Flow of Event(s) | 1. This use case starts when administrator add new serial number  
|                   | 2. System validate serial number information, avoid duplicate information  
|                   | 3. Serial number information save into system  
|                   | 4. Use case end. |

10. Use Case Specification: View Serial Number

| Actor(s)      | Primary     : administrator  
|               | Secondary   : System → Passive (Retrieve serial number information from database). |
| Brief Description | This use case allows administrator to view serial number |
| Activation Condition(s) | Upon Request. |
| Pre-Condition(s) | Serial number had been created by administrator |
| Flow of Event(s) | 1. This use case starts when administrator request to view serial number  
|                   | 2. The system display serial number list  
|                   | 3. Use case ends. |
### 11. Use Case Specification: Pay to Partner

| Actor(s)         | Primary : administrator  
|                  | Secondary : System → Passive (Retrieve partner information). |
| Brief Description| This use case allows administrator to view and pay to partner. |
| Activation Condition(s) | Upon Request. |
| Pre-Condition(s) | Partner information exist in system |
| Flow of Event(s) | 1. This use case starts when administrator request to view partner information  
|                  | 2. The system display partner list and money value need to pay  
|                  | 3. Enter cheque information  
|                  | 4. System recalculate remaining money value  
|                  | 5. Use case ends. |
APPENDIX B: QUESTIONNAIRE FORM

1. How long have you been using the Internet?
   □ 1 year of below
   □ 1-3 years
   □ 4-6 years
   □ 7 years and above

2. Can you access to Internet at home / work?
   □ Yes
   □ No

3. Have you ever perform online shopping?
   □ Yes
   □ No
   If you answer is ‘Yes’, please continue to question 5
   If your answer is ‘No’, please skip to question 14 & 15.

4. When did you last purchase using the Internet?
   □ 1 week ago
   □ 1 month ago
   □ 2 months ago
   □ 3 months ago
   □ 4 months ago
   □ 5 months ago
   □ 6 months ago or more

5. How often do you use the Internet to purchase item?
   [1=very rarely 2=rarely 3=often 4=very often]

   1 2 3 4

6. If you want to purchase items on the Internet, you believe the Internet can provide sufficient information for comparison & consideration.
   [1=strongly disagree 2=disagree 3=agree 4=strongly agree]

   1 2 3 4

7. If you want to purchase items on the Internet, you believe the Internet can save you a lot of shopping time.
   [1=strongly disagree 2=disagree 3=agree 4=strongly agree]

   1 2 3 4
8. When you purchase items on Internet, you believe the Internet can provide the level of security needed.
   [1=strongly disagree 2=disagree 3=agree 4=strongly agree]
   1 2 3 4

9. When you purchase items on Internet, you believe the Internet can provide the level of privacy needed.
   [1=strongly disagree 2=disagree 3=agree 4=strongly agree]
   1 2 3 4

10. When you purchase items on Internet, you believe financial loss risk is low.
    [1=strongly disagree 2=disagree 3=agree 4=strongly agree]
    1 2 3 4

11. Do you believe that online payment is better when using anonymous prepaid electronic money compare to credit/debit card?
    [1=strongly disagree 2=disagree 3=agree 4=strongly agree]
    1 2 3 4

12. Do you prefer to enter lesser information during online payment?
    [1=strongly disagree 2=disagree 3=agree 4=strongly agree]
    1 2 3 4

13. Will you purchase items on the Internet again in the future?
    [1=very unlikely 2=unlikely 3=likely 4=very likely]
    1 2 3 4

14. What is your age range?
    □ 19 or below
    □ 20-30
    □ 31-40
    □ 41-50
    □ 51 or above

15. What is your monthly income level?
    □ RM 2,000 or below
    □ RM 2,001 – RM 6,000
    □ RM 6,001 – RM 10,000
    □ RM 10,001 or above
APPENDIX C: SEQUENCE DIAGRAM

Sequence Diagram: Log-On Scenario

Figure 1: Web-based E-Money Sequence Diagram: Logon Scenario
Sequence Diagram: View Shopping Item

Figure 2: Web-based E-Money Sequence Diagram: View Shopping Item

Sequence Diagram: Shopping Cart

Figure 3: Web-based E-Money Sequence Diagram: Shopping Cart
Figure 4: Web-based E-Money Sequence Diagram: Make Payment
Figure 5: Web-based E-Money Sequence Diagram: Check Card

Figure 6: Web-based E-Money Sequence Diagram: View History
Figure 7: Web-based E-Money Sequence Diagram: Create Item

Figure 8: Web-based E-Money Sequence Diagram: Create User
Figure 9: Web-based E-Money Sequence Diagram: Create Serial Number

Figure 10: Web-based E-Money Sequence Diagram: View Serial Number
Figure 11: Web-based E-Money Sequence Diagram: View and Pay to Partner
APPENDIX D: TEST CASES

A) Test Cases for E-money Issuer System

1. Test Case for Login Screen with Valid User Name and Password

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Login Screen with Valid User Name and Password</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Valid User Name and Password had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>User Name=Admin; Password=123456</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Enter Login Screen  
               2. Enter Valid User Name  
               3. Enter Valid Password  
               4. Click [Login] button |
| Expected Result: | User successfully login to home page |
| Pass/Failed: | |

2. Test Case for Login Screen with Invalid User Name or Password

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Login Screen with Invalid User Name or Password</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Valid User Name and Password had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>User Name= Test; Password= Test</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Enter Login Screen  
               2. Enter Invalid User Name  
               3. Enter Invalid Password  
               4. Click [Login] button |
| Expected Result: | Error message will appear:  
                    “Invalid Username/Password. Access is denied”  
                    User failed to login. |
| Pass/Failed: | |
3. Test Case for Partner Listing and Payment Page with Valid Amount

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Partner Listing and Payment Page with Valid Amount</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Partner List had been created; Current e-money value = 2000</td>
</tr>
<tr>
<td>Test Data:</td>
<td>Cheque Number=123456; Payment Amount=1000</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Expand “E-money Maintenance” at the left pane  
               2. Select “E-money Partner” in the tree view  
               3. E-money partner list will display  
               4. Choose a company name, check the e-money value for the chose company  
               5. Click on [Pay] button of the beside the company  
               6. “E-money Partner Payment” page will show  
               7. Company Name and current e-money will be display same as the main page  
               8. Enter Cheque Number and Payment Amount  
               9. Click on [Pay] button |
| Expected Result: | The value of current e-money value for the company will reduce by the formula below:  
                           New Value = Old Value – Payment Amount |
| Pass/Failed:  | |

4. Test Case for Partner Listing and Payment Page with Invalid Amount

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Partner Listing and Payment Page with Invalid Amount</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Partner List had been created; Current e-money value = 2000</td>
</tr>
<tr>
<td>Test Data:</td>
<td>Cheque Number=123456; Payment Amount=9999</td>
</tr>
</tbody>
</table>
| Steps:       | 10. Expand “E-money Maintenance” at the left pane  
               11. Select “E-money Partner” in the tree view  
               12. E-money partner list will display  
               13. Choose a company name, check the e-money value for the chose company  
               14. Click on [Pay] button of the beside the company  
               15. “E-money Partner Payment” page will show  
               16. Company Name and current e-money will be display same as the main page  
               17. Enter Cheque Number and Payment Amount  
               18. Click on [Pay] button |
| Expected Result: | The value of the amount is not able to deducted because Payment Amount>Current e-money Value |
| Pass/Failed:  | |
5. Test Case for Create New Serial Number

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Create New Serial Number</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Predefined value is RM10, RM30, RM50 and RM100</td>
</tr>
<tr>
<td>Test Data:</td>
<td>Quantity=1; Money Type=RM50</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Expand “E-money Maintenance” at the left pane  
               2. Select “Generate Serial” in the tree view  
               3. Create Serial Number Page will show  
               4. Enter the “Quantity” to be created  
               5. Select “Money Value” from the drop down list  
               6. Click [Generate] button |
| Expected Result: | The new serial number will be generated in Ringgit Malaysia and e-money value (equivalent to the Ringgit Malaysia selected). For example RM 100 will contain 10,000 e-money values. |
| Pass/Failed: | |

6. Test Case for View Serial Number Page

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for View Serial Number Page</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Few Serial Number had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>-</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Expand “E-money Maintenance” at the left pane  
               2. Select “View Serial” in the tree view |
| Expected Result: | The “E-money Serial Number” listing page should will shown |
| Pass/Failed: | |
B) Test Cases for E-money Partner System

1. Test Case for Login Screen with Valid Admin User

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Login Screen with Valid Admin User</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Valid Admin User Name and Password had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>User Name=Admin; Password=123456</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Enter Login Screen  
                2. Enter User Name  
                3. Enter Password  
                4. Click [Login] button |
| Expected Result: | “YY Bookstore Admin Home Page” will be shown |

2. Test Case for Login Screen with Valid Normal User

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Login Screen with Valid Normal User</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Valid User Name and Password had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>User Name=YY; Password=123456</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Enter Login Screen  
                2. Enter User Name  
                3. Enter Password  
                4. Click [Login] button |
| Expected Result: | “YY Bookstore Home Page” will be shown |

3. Test Case for Login Screen with Invalid User Name or Password

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Login Screen with Invalid User Name or Password</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Valid User Name and Password had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>User Name=Test; Password=Test</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Enter Login Screen  
                2. Enter Invalid User Name  
                3. Enter Invalid Password  
                4. Click [Login] button |
| Expected Result: | Error message will appear:  
                           “Invalid Username/Password. Access is denied”  
                           User failed to login. |

Pass/Failed:
4. Test Case for View Admin Transaction History Page

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for View Admin Transaction History Page</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Some purchase transaction had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>-</td>
</tr>
<tr>
<td>Steps:</td>
<td>1. Click “My Trx” from Admin Home Page</td>
</tr>
<tr>
<td>Expected Result:</td>
<td>It shows the user name whom perform the online purchase, the product media (eg book, stationery), book title, e-money value (represent the item price) and transaction date.</td>
</tr>
<tr>
<td>Pass/Failed:</td>
<td></td>
</tr>
</tbody>
</table>

5. Test Case for Shopping Page

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Shopping Page</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Shopping Item had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>-</td>
</tr>
</tbody>
</table>
| Steps:        | 1. Click “My Shopping” from User Home Page  
2. “YY Bookstore Shopping” page will show  
3. Select few items display in the catalogue by clicking the item’s picture or the item’s title  
4. Whenever a item is selected, the floating square box called “View My Cart” at the right corner will show the total items selected and the current e-money value in the cart |
| Expected Result: | The e-money value and number of items selected should be correctly display as per selected items. |
| Pass/Failed:  | |
## 6. Test Case for Shopping Cart Page

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Shopping Cart Page</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Shopping Item had been selected into Cart</td>
</tr>
<tr>
<td><strong>Test Data:</strong></td>
<td>-</td>
</tr>
</tbody>
</table>
| **Steps:** | 1. Click “My Cart” from User Home Page  
2. “My Cart” page will show  
3. The list of selected item with each price (in e-money value) will be display  
4. Check the total e-money  
5. Click [Remove] button to remove one of the selected item and recalculate the e-money total  
6. Click [Clear Cart] button to clear all selected item |
| **Expected Result:** | Calculate e-money total and make sure it is correct |
| **Pass/Failed:** | |

## 7. Test Case for Payment Page with One Valid Serial Number

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Payment Page with One Serial Number</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Shopping Item had been selected into Cart and Serial Number had been created</td>
</tr>
<tr>
<td><strong>Test Data:</strong></td>
<td>Serial Number = 766228765, Validate Code=765</td>
</tr>
</tbody>
</table>
| **Steps:** | 1. From “My Cart” page, select payment drop down list, select “E-money” as payment type  
2. Click [Continue Payment] button and payment page will show  
3. Enter Serial Number and Validate code  
4. Click [Add Serial Card] button  
5. Check on the “Remaining” value  
6. Adjust the “Amount to Pay” column to made the remaining value become zero  
7. Click [Complete Purchase] button |
| **Expected Result:** | Remaining value need to be calculated corrected and payment should be proceed successfully |
| **Pass/Failed:** | |
## 8. Test Case for Payment Page with Two Valid Serial Numbers

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Payment Page with Two Serial Numbers</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Shopping Item had been selected into Cart and Serial Number had been created</td>
</tr>
</tbody>
</table>
| **Test Data:** | Serial Number = 766228765, Validate Code=765  
 Serial Number = 683613990, Validate Code=682 |
| **Steps:** | 11. From “My Cart” page, select payment drop down list, select “E-money” as payment type  
12. Click [Continue Payment] button and payment page will show  
13. Enter Serial Number and Validate code  
14. Click [Add Serial Card] button  
15. Check on the “Remaining” value  
16. Add 2\textsuperscript{nd} Serial Number and Validate Code  
17. Click [Add Serial Card] button  
18. Check on the “Remaining” value  
19. Adjust the “Amount to Pay” column to made the remaining value become zero  
20. Click [Complete Purchase] button |
| **Expected Result:** | Remaining value need to be calculated corrected and payment should be proceed successfully |
| **Pass/Failed:** | |

## 9. Test Case for Payment Page with Invalid Serial Number

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Payment Page with Invalid Serial Number</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Shopping Item had been selected into Cart and Serial Number had been created</td>
</tr>
<tr>
<td><strong>Test Data:</strong></td>
<td>Serial Number = 999999999, Validate Code=999</td>
</tr>
</tbody>
</table>
| **Steps:** | 1. From “My Cart” page, select payment drop down list, select “E-money” as payment type  
2. Click [Continue Payment] button and payment page will show  
3. Enter Serial Number and Validate code  
4. Click [Add Serial Card] button |
| **Expected Result:** | Serial Number Invalid Error Message Pop Up |
| **Pass/Failed:** | |
### 10. Test Case for Payment Page with Invalid Validate Code

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Payment Page with Invalid Validate Code</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Shopping Item had been selected into Cart and Serial Number had been created</td>
</tr>
<tr>
<td><strong>Test Data:</strong></td>
<td>Serial Number = 766228765, Validate Code=999</td>
</tr>
</tbody>
</table>
| **Steps:** | 5. From “My Cart” page, select payment drop down list, select “E-money” as payment type  
6. Click [Continue Payment] button and payment page will show  
7. Enter Serial Number and Validate code  
8. Click [Add Serial Card] button |
| **Expected Result:** | Serial Number Invalid Error Message Pop Up |
| **Pass/Failed:** | |

### 11. Test Case for Check Card Page with Valid Serial Number

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Check Card Page with Valid Serial Number</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Serial Number had been created</td>
</tr>
<tr>
<td><strong>Test Data:</strong></td>
<td>Serial Number = 766228765, Validate Code=765</td>
</tr>
</tbody>
</table>
| **Steps:** | 1. Click “Check Card” from User Home Page  
2. “Check Card” page will show  
3. Enter Serial Number and Validate Code  
4. Click [Check Serial Card] button |
| **Expected Result:** | Remaining value for the serial number will be displayed |
| **Pass/Failed:** | |

### 12. Test Case for Check Card Page with Invalid Serial Number

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose:</strong></td>
<td>Test Case for Check Card Page with Invalid Serial Number</td>
</tr>
<tr>
<td><strong>Prerequisite:</strong></td>
<td>Serial Number had been created</td>
</tr>
<tr>
<td><strong>Test Data:</strong></td>
<td>Serial Number = 999999999, Validate Code=999</td>
</tr>
</tbody>
</table>
| **Steps:** | 1. Click “Check Card” from User Home Page  
2. “Check Card” page will show  
3. Enter Serial Number and Validate Code  
4. Click [Check Serial Card] button |
| **Expected Result:** | Serial Number Invalid Error Message Pop Up |
| **Pass/Failed:** | |
13. Test Case for Check Card Page with Invalid Validate Code

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for Check Card Page with Invalid Serial Number</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Serial Number had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>Serial Number = 766228765, Validate Code=999</td>
</tr>
</tbody>
</table>
| Steps:       | 1. Click “Check Card” from User Home Page  
              | 2. “Check Card” page will show  
              | 3. Enter Serial Number and Validate Code  
              | 4. Click [Check Serial Card] button |
| Expected Result: | Serial Number Invalid Error Message Pop Up |
| Pass/Failed: | |

14. Test Case for View User Transaction History Page

<table>
<thead>
<tr>
<th>Test Case ID:</th>
<th>020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose:</td>
<td>Test Case for View User Transaction History Page</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>Some purchase transaction had been created</td>
</tr>
<tr>
<td>Test Data:</td>
<td>-</td>
</tr>
<tr>
<td>Steps:</td>
<td>1. Click “My Trx” from User Home Page</td>
</tr>
<tr>
<td>Expected Result:</td>
<td>It shows the records for the login user on his/her online purchase history, the product media (eg book, stationery), book title, e-money value (represent the item price) and transaction date.</td>
</tr>
<tr>
<td>Pass/Failed:</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E: EVALUATION FORM

a) Evaluation Form for Online Consumers

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Yes</th>
<th>No Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you agree e-money is an anonymous payment system?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Do you think e-money is easy to use?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Do you think e-money is more secure compare to credit card?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Do you trust e-money is a better alternative payment method for online purchasing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Do you think it is easier to purchase e-money compare to apply credit card?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Do you think e-money is more appropriate to use for small amount online transaction compare to credit card?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Do you agree e-money did not content personal information, hence it protect users privacy?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Do you think e-money will widely used by the online users in future?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Will you buy e-money to perform online purchase?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Will you introduce e-money to your friend?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**b) Evaluation Form for Online Merchants**

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you agree e-money is an anonymous payment system?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Do you think e-money is easy to use?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Do you think e-money is more secure compare to credit card?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Do you trust e-money is a better alternative payment method for online purchasing?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Do you think it is easier for user to purchase e-money compare to apply credit card?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Do you think e-money is more appropriate to use for small amount online transaction compare to credit card?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Do you agree e-money did not content personal information, hence it protect users privacy?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Do you think e-money will widely used by the online users in future?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Do you want to implement e-money as another payment method?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Will you introduce e-money to others merchant?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F: DEPLOYMENT STEP BY STEP

Setting up E-Money Virtual Directory

1. Start Windows Explorer and create 2 new physical directory named EMoney and EMoneyIssuer, under the \Inetpub\wwwroot directory created by IIS on your hard drive.

2. Copy all the EMoney and EMoneyIssuer files to this directory

3. Then, click Start, point to Programs, point to Administrative Tools, and then click Internet Information Service.

4. Expand <domain name> by clicking +. Right click on Default Web Sites and point to New, select Virtual Directory. You will see the splash screen of the Virtual Directory Creation Wizards. Click on [Next].

5. Type EMoney in the Alias text box; then click on [Next].

6. On the next screen, click [Browse] button and select the directory \Inetpub\wwwroot\EMoney that you have created in step 1. Then, click [Next].

7. Make sure that the Read and Run scripts checkboxes are checked, and that the Execute checkbox is empty. Click on [Next] and then, click on [Finish].

8. Repeat step 4 to step 7 for EMoneyIssuer virtual directory.
9. The EMoney & EMoneyIssuer virtual directory will appear on the tree in the IIS Administration Windows as shown in Figure 1.

**Figure 1: Internet Information Services**
10. Right click on the EMoney Virtual Directory and select **Properties**.

![Virtual Directory Properties](image)

**Figure 2: Virtual Directory Properties**

11. You will notice that you have created an application called EMoney – the same as the virtual directory. If the box next to the application name is blank, you need to hit the [Create] which will turn into [Remove]. This is to enable us to use Global.asa in the scripts.

12. Check only the **Read** checkbox.

13. Exit **IIS**.
Setting up E-Money Database

1. Make sure Microsoft SQL Server 2005 is installed and the SQL Server service is started.

2. Click Start, point to Programs, point to Microsoft SQL Server 2005, and then click Microsoft SQL Management Studio.

3. Click [Connect] after enter the Server name as shown in figure 3.

4. Expand <server name> by clicking +. Right click on Databases and click on New Database. You will see window to create New Database.

5. Enter EMoney into the Database Name and check the path to store the database file shown in figure 4.
6. Repeat step 4 and step 5 to create EMoneyIssuer database.

7. Run the script to create the table and store procedure for both databases.

8. Expand <server name> by clicking +, expand Security and expand Login. Then right click on sa and select Properties. Enter a strong password and click [OK].

Setting up XML Configuration File

1. Start Windows Explorer and point to the directory named EMoney and EMoneyIssuer, under the \Inetpub\wwwroot directory used by IIS on your hard drive.

2. Open the XML configuration file \Inetpub\wwwroot\EMoney\Web.config.

3. Edit the key for “EComConnectionString” and “IssuerConnectionString” to point to the database that just created. See Figure 5.

   Data Source: Server Name

   Initial Catalog: Database Name

   User Id: Database User Name (eg. sa)

   Password: Password for the User ID

4. Click File->Save to save the Web.config file after change.


6. Repeat Step 2 to Step 5 to set up the config file for EMoneyIssuer.
Create User Password with Encryption

1. Open Internet Explorer open the page: http://localhost/EMoney/MyPassword.aspx

   which had been set up in the virtual directory at IIS. See figure 6.

   ![Encrypt Password Page](image)

   **Figure 6: Encrypt Password Page**

2. Enter a desire password in the Input text box and click [Encrypt].

3. Copy the encrypted password from the Output text box to update in the table user in the database. See figure 7.
Figure 7: Update Password into Database
APPENDIX G: USER MANUAL

Introduction

This user manual explains the web-based e-money system usage. Below is the current development of the system due to system is built up by prototype methodology. There are two modules in the web-based e-money system: e-money issuer and e-money partner (merchant).

There is only administrator design for e-money issuer module. For e-money partner system, user can login as administrator which allows performing administrative task and normal user which allow performing online purchasing. The e-money partner can be any online electronic commerce that using e-money as their payment method. In this system; online bookstore is used to bring up the concept of web-based e-money as a payment type for online purchasing.
E-Money Issuer System

E-Money Issuer Login Page

To enter the e-money issuer system, user need to key in a valid user name and password. The username also use to indicate whether the user is an administrator or a normal user. Click the “Login” button after key in the username and password.

Error message: “Invalid Username/Password. Access is denied” will be prompted if the user name OR password given was incorrect.
E-Money Partner Listing Page

In the e-money partner listing page is will show the partners that participate in the payment system. The listing consist of the name of the participate partner, the current e-money value that is in the partner account that need to be pay. In each row, there’s a “Pay” button that will link to a page that allow the Issuer admin to pay the remaining e-money value to the partner.

Each page will only show 10 rows of records, for row 11 to 20, it will show in page 2 and etc. The number at the bottom of the list is the page number that allow user to show page 1, page 2 etc.

Click the “Pay” button beside each partner will open the respective payment page to the partner.
E-Money Partner Payment Page

The e-money partner payment page is used to perform the payment to each of the partner. When a customer purchases an item in the partner's online store with the payment type of e-money, the value will be accumulated into the partner's account. By month end or certain period, issuer will pay the partner accordingly to the e-money value accumulated in their account. Issuer will sign a cheque and update the system with the cheque number and amount that have been paid to the partner.

In the page, it shows the partner’s company name and the current e-money accumulated in the partner’s account. Administrator will enter the cheque number and the payment amount in the box and click “Pay” button to complete the payment process to the partner.
Create Serial Number Page

E-money was represented in serial number form. Each serial number means a web-based e-money card which content different amount of e-money value.

User can enter the quantity of serial number to be created and the money type that have been predefined in the system. eg: RM10, RM30, RM50 and RM100.

User must key in a numeric number in the quantity column and select the money type from the drop down list. Click the “Generate” button to generate the new serial number with the selected value from the money type. The new serial number will be generated in Ringgit Malaysia and e-money value (equivalent to the Ringgit Malaysia selected. For example RM 100 will contain 10,000 e-money values.
View E-Money Serial Number Page

User can always view the e-money serial number that exists in the system from this page. User can search the serial number by enter the serial number and click the button to search respective records.

In the table list, it shows the serial number; validate code, e-money value and status. Validate code is a 3 digit number similar to a credit card validation code which need to be enter during online transaction to make sure the card is a valid card for security purpose. E-money value is the value that currently holds by the card, it will be deduct accordingly when customer uses the value in the card. Status show the card is an active (value 0) or inactive card (value 1).
Each page will only show 10 rows of records, for row 11 to 20, it will show in page 2 and etc. The number at the bottom of the list is the page number that allow user to show page 1, page 2 etc.
E-Money Partner System

E-money partner actually is the merchants/partner that participates in the web-based e-money payment system. In the development, an online bookstore named “YY Bookshop” is created to show the concept of how web-based e-money been used as an online payment method. This bookshop allow user to purchase book online and make payment online.

E-Money Partner Login Page
To enter the e-money partner system, user need to key in a valid user name and password. The username also use to indicate whether the user is an administrator or a normal user. Click the “Login” button after key in the username and password.

Error message: “Invalid Username/Password. Access is denied” will be prompted if the user name OR password given was incorrect.
**Administrator Main Page**

If the user is an administrator, page below will be shown:

![Image of Administrator Main Page]

This home page allow user to select 3 options:

a) **My Item**: Allow administrator to create, edit and delete shopping item

b) **My User**: Allow administrator to create, edit and delete user

c) **My Trx**: Allow administrator to view the transaction history
View Transaction History Page

When click the “My Trx” option in the home page, the view transaction history page will be shown. This page allow administrator to view the transaction history. It shows the user name whom perform the online purchase, the product media (eg book, stationery), book title, e-money value (represent the item price) and transaction date.
User Home Page

If the user is not an administrator, this page below will be shown:

This home page allow user to select 3 options:

a) My Shopping: Allow user perform online shopping
b) My Cart: Shopping cart that store the temporary purchase item before payment
c) Check Card: Allow user to check the e-money remaining value
d) My History: Allow user to view the previous transaction history
**User Shopping Page**

When click the “My Shopping” option from the home page, the user shopping page will be shown. In this user shopping page, items list will appear. User can view the item picture, item name, author name and price (shown in e-money value).

User can select the desirable item to purchase and click the “Add to My Cart” button to add the selected item to the shopping cart. A floating display will show the current number of item in the cart the value to be paid. (see the right upper corner).
Shopping Cart Page

When click the “My Cart” option from the home page, the shopping cart page will be shown. In this shopping cart page, user can view the item that they put in the cart previously.

This page will list out the product media of the item, book title, ISBN number, author name, price (in Ringgit Malaysia), e-money value (equivalent to the price) and a remove button. User can see the total e-money value that need to pay and the total Ringgit Malaysia that equivalent. User can remove the item from the cart by clicking the “Remove” button and the new total e-money value and total Ringgit Malaysia will be recalculate.

At the bottom of the page, there’s 2 buttons: “Continue Purchase” and “Clear Cart”. To proceed with payment, user need to select payment type from the drop down box (eg, web-based e-money, credit card etc) and click the “Continue Purchase”.

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Payment Page

This is a web-based e-money system, so it will only show the payment page when user select web-based e-money as the payment type from previous page. This page supposes to be the 3rd party gateway but in this prototype, it will only show the concept of the process flow.
This page will show the Total e-money value which user need to pay. User need to enter the web-based e-money card serial number and validate code and click the “Add Serial Card” button. When the button is click, it will link to the issuer database to validate the serial number, only valid serial number will be accepted else warning message will be appeared.

If one card (serial number) is not enough to make the payment, this system allows multiple cards per transactions. User can add another prepaid card serial number and check the remaining e-money value that need to pay.

There’s a listing table show at the center of the page where it shows the serial number list and e-money value from the card. User can enter the amount need to pay from the respective serial number or even remove the card from the list.

When the remaining value becomes zero, the previously grayed out button “Complete Purchase” will now allow to be click to complete the payment or user can choose the “Clear Card” button to clear the list and cancel the purchase.
Check Card Page

When click the “Check Card” option from the home page, the check card page will be shown. In this page, user can enter the serial card number and validate code to check the remaining value on the card. When user click the “Check Serial Card” button, it will link to the issuer database to retrieve the serial number card information.
View Transaction History Page

When click the “My History” option from the home page, the view transaction history page will be shown. This page shows the transaction that previously done by the user. It displays the list of product media, book title, ISBN number, author name, e-money value and the purchased date.

Sign Out

User can click the “Sign Out” link appear at the left upper corner in each page if they wish to log out from the page system and it will bring back the login page.