Light-Weight Digital Receipt System

By

Koh Chee Hong

Dissertation submitted in partial fulfillment of

The requirements for the Bachelor of Technology (Honours)

(Business Information System)

May 2011

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

Parak Darul Ridzuan

CERTIFICATION OF APPROVAL

Light-Weight Digital Receipt System

by

KOH CHEE HONG

A project dissertation submitted to the
Business Information Systems Programme

Universiti Teknologi PETRONAS

In partial fulfillment of the requirement for the
BACHELOR OF TECHNOLOGY (Hons)
(BUSINESS INFORMATION SYSTEMS)

Approved by,
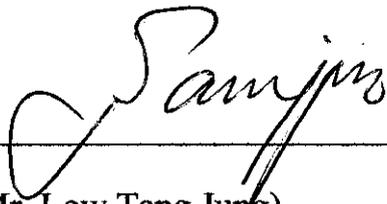
_____
(Mr. Low Tang Jung)

Low Tanjung
Senior Lecturer
Computer & Information Sciences
Universiti Teknologi PETRONAS
31750 Tronoh
Perak Darul Ridzuan, MALAYSIA.

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
May 2011

CERTIFICATION OF ORIGINALITY

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

(KOH CHEE HONG)

ACKNOWLEDGEMENTS

My greatest appreciation and gratitude will firstly dedicate to my supportive supervisor, Mr. Low Tang Jung. As a supervisor, he never failed to guide me through hardships encountered throughout the Final Year Project I and II.

Never forget to express my utmost appreciation to my dear CIS department lecturers, who have also provided me guidance and knowledge throughout the journey in accomplishing the project.

Last but not least, special thanks I would like to dedicate to Universiti Teknologi PETRONAS for providing me such an opportunity and platform to obtain so much knowledge throughout the Final Year Project Programme.

ABSTRACT

The sole purpose of this project is to develop a light-weight digital receipt system that can counter the short-comings of the conventional digital receipt system and meet the market expectations desirably. The proposed system mainly focuses on achieving simpler receipt data extraction, leverage the use of server to a third party and eliminate as much cost as possible. The approach proposed is mainly used to counter problems and complications which are found in existing digital system nowadays. The author believes that retrieving receipt data must not necessary be done at the server, but could also be done at the POS system, particularly at the printer point. Besides, the author's proposed digital receipt will not require any reconfiguration processes to be done at retailer's POS system, which retailers will not need to worry for their POS system being modified just to integrate with digital receipt applications. The author will strive to produce a digital receipt system that is very cost-effective as compared to the conventional digital receipt system so that both retailer and customer can afford to use such as technology.

TABLE OF CONTENT

TABLE OF FIGURES

List of Tables

CHAPTER 1: INTRODUCTION

In this chapter, the author will discuss thoroughly about the overview of this ongoing research. This chapter will include the following topics:

- Section 1.1 – BACKGROUND OF STUDY
- Section 1.2 – PROBLEM STATEMENT
- Section 1.3 – OBJECTIVES AND SCOPE of STUDY
- Section 1.4 – FEASIBILITY OF THE PROJECT
- Section 1.5 – EXPECTED OUTCOMES
- Section 1.6 – CHALLENGES

1.1 BACKGROUND OF STUDY

As the title of the project suggests, this project sole objective is to produce a light-weight digital system technology which is very much cheaper than those existing ones. The light-weight technology here refers to a kind of technology that is capable of producing good results for the amount of money spent. Apparently digital receipt technology has existed since 2000 and no longer consider as a new technology, but due to its nature of technology, both retailers and customers who use current digital receipt system are demanded to pay for its setup and implementation and the cost is always high [2]. The author has seen the great potential of digital receipt in saving the environment by eliminating and replacing paper receipt with digital receipt. The author has also seen the need to suggest a Light-weight digital receipt system in order for the digital receipt concept to expand as fast as possible

around the globe. This project is not meant to create or invent another highly new technological product or system, but to practically observe and analyze the current digital receipt systems in the market and recommend better technical solutions for further improvements.

For decades businesses have been using paper receipt as mean to facilitate buying and selling transactions and such a practice still continue till today. Receiving paper receipt has become an essential shopping experience of every customer. However, the customer may find a paper receipt less than ideal because it can be easily lost, damaged, or destroyed. This could be a problem when the customer wishes to use paper receipts to organize his personal finances or to return purchased items. If the receipt is damaged to a point where it's no longer valid, the customer may not be able to properly document and manage his accounting [1].

1.2 PROBLEM STATEMENT

1.2.1 Problem Identification

Problems with conventional digital receipt system:

1. Receipt data are extracted in-situ at POS back-end environment and thus modification on retailers' POS is necessary

The digital receipt technology must be simple to use, both at the point of purchase and in the home [2]. If the digital receipt is going to have mass market appeal, it must be usable with a minimum amount of explanation and training. The problem with the current digital receipt technology is that it requires retailers to give way for the digital receipt service providers to alter, install, modify or re-configure some settings or architecture of the Point-of-Sales (POS) system in order to operate the digital receipt functions. Such configuration on retailers' POS system has caused great worries to retailers as some of they might concern about the complications that happen after the installation. Complexity increases the risk of problems concerning security. A complex design is never easy to understand, and therefore, is more likely to include subtle problems [1]. To avoid this kind of trouble, the implementation needs to be as straightforward as possible in the software development process [1]. For customers who receive digital receipt should also able to retrieve their digital receipt easily from an assigned destination(s). According to one of the largest digital receipt providers, Alletronic, implementation of the digital

12

receipt system and configuration on the POS system will take approximately 6 to 8 weeks to complete [16].

2. Complicated installation procedure at retailer's POS – Server Issue

The networking architecture that proposed by the current existing digital receipt technology has made the whole digital receipt idea to become extremely difficult, costly, and technological-sophisticated to implement. The current generic digital receipt technology suggests that server and multiple networking languages such as SIM (Subscriber Identity Module), (SSL Secure Sockets Layer), RMI (Remote Method Invocation), RPC (Remote Procedure Call) and so [1]. Setting up such network architecture and implementing the network protocols is a time-consuming and expensive. Network specialist's service is required as setting up such architecture is never easy. It is believed that such complexity in setting up the digital receipt network architecture has caused the slow expansion of digital receipt across the world. The reason for setting up such sophisticated network architecture is because the digital receipt service provider would want to store and tract every single data captured from the piece of receipt in every transaction made by customers [2]. Therefore, the digital service provider would be able to obtain valuable data especially on customers' buying behaviours. Such complicated network architecture could be eliminated and be replaced with a very much simpler, cost-effective and readable networking technology.

13

3. High Implementation Cost

All the complexity of system and network architecture of the conventional digital receipt system has led to a overall high implementation cost. According to the implementation cost calculated by QuickReceipt, one of the digital receipt providers, the cost of hosting a server will be as high as $4800 per year and can increase to $10,000 if the storage were to expand [17]. This has not included the charges for labour fees for setting up the all installation and also the utilities cost, which all in all piled up to approximately $36000 annually [17]. The digital receipt technology has not even been found in Malaysia market yet till today. Such slow expansion is very much due to the complex implementation of digital receipt system. Besides, retailers and customers are reluctant to pay for the charges by using the digital receipt services. Digital Receipt concept itself is a great beneficial technology that could contribute a huge part to our environment and some even titled the digital receipt to be "New Green Technology" due to its capability by eliminating the use of paper receipt and save trees [6]. Moreover, some receipt used in the market today is made from thermal paper – a non-recyclable material [5]. Receipt paper demands in the US are 640,000 tons per year. This equates to 9,600,000 trees cut down each year just to produce paper receipts [6]. There is a need for the world to quickly utilize such the digital receipt in order to safe-guard the environment, and the most practical to achieve this is to take advantage on another much simpler and readable digital receipt technology to replace the current ones. By

such, it gives way for digital receipt to expand faster and gain its popularity at the shortest possible time.

1.3 OBJECTIVES AND SCOPE OF STUDY

1.3.1 Objectives

Develop a new concept digital receipt system:

- ✓ **that receipt data is retrieved at the printer environment and no modification on POS is required**
- ✓ **which is extremely simple to install - No server is required to be built, leverage the use of server to a third party**
- ✓ **which has low implementation cost – could be as low as zero for both customer and retailer and therefore served as an advantage to gain positive response**

1.3.2 Scope of Study

The scope of study will very much focus on the current digital receipt system implementation process and its architectural nature. By understanding the implementation processes of the current Digital Receipt system, it will be easier for the author to identify the weak-spots and recommend possible solutions. A clearer view about the current architecture of the digital system could give inspirations to the author to simplify it as much as possible.

The current Digital Receipt System is basically divided into four important phases, which are:

i. Installation of Digital Receipt Components into POS system [1]

ii. Setting up the networking architecture for Digital Receipt System [1]

iii. Implementation of Security Measures in Digital Receipt System [1]

Besides, the author will also study about the current market and environment and analyze the possible response that the market will give if the proposed system is introduced.

1.4 FEASIBILITY OF THE PROJECT

1.4.1 Scope Feasibility

This project paper will focus mainly on implementing a Light-weight digital receipt application. As to create a digital receipt application that very much cheaper than others, the author has planned to eliminate the current dependency on servers and its complicated network architecture. Instead of accessing the database to extract data, the author intends to target the receipt printer and capture the receipt image from the printing environment of the POS system. To capture the image, the POS system needs to interact with receipt printer once the receipt printer is triggered to print the receipt in paper form. Thus

far there is no one entity that has started implementing digital receipt in such a way, which is to target the printing environment rather than the back-end environment. According to research the author has found that AutoIt has enabled the interaction of POS system and the receipt printer to happen. For the initial stage, the author will firstly target on POS system that operates in Window platform environment, since most of the POS systems nowadays are using Window as its operating platform.

1.4.2 Schedule Feasibility

The development of this project will take approximately 2 semesters in which it will be divided into two parts. The first part of this project or FYP Part 1 will cover the planning, requirement analysis and design phase. Other than that, the first part of the project will also involve with in-depth study of current application and the relevancy of this project.

The second part of this project or FYP Part 2 will commence in the second semester whereby the output from part 1 will be transformed into workable codes and testing and maintenance procedure will be executed.

1.4.3 Technical Feasibility

The construction of the system will greatly depend on the AutoIt programming, a programming language that very much similar to C++ language as well. AutoIt is generally used to create instructions and commands that interact with the Windows system. doPDF is an open source application to convert receipt image to PDF files.

1.5 Expected Outcomes

1.5.1 Eliminate Difficult Installation Procedure

The author aims to eliminate as much difficult installing procedure as possible. As the current digital receipt usually requires business operations to shut down for hours or days in order to install the Digital Receipt Functionalities on the retailer's POS system [1], many retailers have reluctant to give way for the installation to take place. The author intended to make the digital receipt system a small executable file that can be easily downloadable from the internet. The retailers will only need to download the executable file and directly install it in the POS system. There settings will automatically be configured by itself within seconds and retailers will barely need to do anything.

1.5.2 Eliminate the Need to Access to Database and POS Back-end Environment

The current digital receipt systems will usually access into retailer's POS back end environment in order to retrieve the receipt information. [1][3] This creates a sense of insecurity to retailers as the business data is continuing being exposed by a third party. The author aims to create a digital receipt system that will not have any access into the back-end environment. Instead, the proposed system will retrieve the receipt information from the printing environment of the POS system. Therefore, only receipt information will be captured.

1.5.3 Elimination of Complicated Network Architecture

The implementation of current digital receipt systems usually demand retailer to set up their own server to host and store the digital receipt [1][3]. Thus, retailers might need to allocate money to set up server and implement server protocols. The author aims to totally leverage the storage and data transfer operations to the public servers, which require no charges at all. The public servers could be Gmail, Hotmail and others.

1.5.4 Conversion of Customer's Email into Barcode

One of the desired outcomes is that customers can take the initiative to convert their email address into barcode. The purpose of converting email address to barcode is simple. In order to send digital receipt to

the accurate customer's email addresses without any problem such as typing errors. There are many websites today that help users to create barcodes from alphanumeric figures. The conversion is usually being done online and is totally free of charge. The barcode created will be carried along with the customers to the retailers. When they ask for a digital receipt, they will need to present their created barcode that represents their email address. The retailers will use their own barcode reader, which is already equipped in place, to read the barcode and transfer the digital receipt to the scanned email address from the barcode. A website will be built to pull customers to a central point and provide them a step by step instruction to convert their email address into barcode format. Below is the list of few websites that provide fast and free barcode generating service:

Website Name	URL
BarCodeInc	http://www.barcodesinc.com/generator/index.php
BarCodeSoft	http://www.barcodesoft.com/online-barcode-generator.aspx
Morovia	www.morovia.com/free-online-barcode-

	generator/
TerryBurton	www.terryburton.co.uk/barcodewriter/generator/

Table 1: List of few websites that provide fast and free barcode generating service

To create a one-stop station for customer to get to know more about the digital receipt, as well as a exclusive site for them to generate their barcode specially for digital receipt purpose, the author will create and implement a website solely for customer to generate barcode and obtain information. Posters will be placed at the retailer's store in order to acknowledge the customers about the existence of the site and guide them how to create their own barcode in the website.

1.5.5 Cost Effective

Since the proposed system is simple and takes out very minimal costing, the author is able to propose a very much lower charge for public than the current existing digital receipt service provider. The proposed system can possibly cheaper by double or triple of the current rate.

1.6　Challenges

1.6.1　Limited Access to Original Sources

As far as the intellectual property issue is concerned, the author encountered difficulties in finding resources or information about the currenting market existing digital receipt systems. Most of the jounals and research works only define and explain the technological and architectural context of the digital receipt systems in a very high level basis. However, the author still able to obtain significantly detailed information from the patented digital receipt system papers and journals. Internet remains the most helpful tools to acccess to essential information about constrcuting a digital rceipt system.

1.6.2　High degree of skills and knowledge in C++ language is required

The generic digital receipt system architecture covers three basis parts: the setup of digital receipt system, the setup of network architecture of the digital receipt system and the security setup. All these three parts require good command of C++ programming language. As a student who only has limited understanding about C++, using the application constructing tool like AUTO that used C++ as its core for system building could be challenging.

1.6.3 Alert for Customer upon the Receipt of Digital Receipt through Mobile Phone

Alerting the customer through mobile phone for every receipt of digital receipt is possible and can be easily implemented in the lab environment through the modem with SMS (Short Messaging Service) function. However, if this alerting function were to be implemented in the real market, further collaboration with the SMS providers such as Celcom, Maxis, Digi and others will be needed. Therefore, it is challenge for the author to really produce a highly marketable digital receipt system so that collaboration with third parties is possible.

CHAPTER 2: LITERATURE REVIEW

2.1   Current Existing Digital Receipt Service Providers

Since the initial introduction by the Digital Receipt Alliance in January 2000, much progress has been made towards establishing and maintaining a digital receipt standard that will enable this exciting new technology to fully deliver on its promise [2]. Many companies have slowly realized the potential of digital receipts. The major digital receipt companies are listed with its country in the following table:

Digital Receipt Company	Country	Website
MyReceipts	United States	http://www.myreceipts.com/
3Second Receipt	United States	http://www.3secondreceipts.com/
TransactionTree	United States	http://www.transactiontree.com/
QuickReceipt	United States	http://myquickreceipts.intuit.com/
Ecrebo	United States	http://www.ecrebo.com/
allEtronic	United States	http://www.alletronic.com/
afterBOT	United States	http://www.afterbot.com/

yReceipt	United Kingdom	http://www.yreceipts.com/
Kvittar	Sweden	http://kvittar.se/this-is-kvittar/

Table 2: The major digital receipt companies in the world

As seen from the table, most of the digital receipt companies are located in United States and they have yet come to be very popular in the Asian and European market. The slow expansion of digital receipt since 2000 has shown that the current existing digital receipt technology requires further amendment and improvement in order to gain better response from the globe. Hence, the purpose of this research is to target the problems with current digital receipt technology and counter with them using a much simplified and innovative IT solutions and new breakthroughs.

2.2 Conventional Digital Receipt System/ Application

2.2.1 Conventional Digital Receipt System Architecture

Digital Receipt is no longer a brand new technology in the market nowadays as it has been introduced since the year 2000 [2]. The generic implementation of the digital receipt system is basically divided into four main parts, which are the installation of Digital Receipt components into POS system, setting up the networking architecture for Digital Receipt System, setting up Digital Receipt Mobile Transmission and the implementation of security measures in

Digital Receipt System [1] [3] [4]. PDF (Portable Document File) is the common file format for digital receipt in market. For every business transaction, the data captured such as the products, quantity, price, subtotal price and total, tax charges, service charges and so will be captured by POS system and send it over to the servers for storage [1]. The common practice is that server will be responsible to generate digital receipt in PDF format. Servlet is a kind of server application used to extract data from the data stored in server [1]. To develop servlet, tools such as Java Development Kit (jdk1.6.0_05) had to be installed and an external servlet library needs to be imported (servlet-api.jar) [1]. The servlets developed are capable of performing the following functions:

- *the creation of the PDF receipt [1][3]*

- *the signing of the PDF receipt [1][3]*

- *the sending of the PDF receipt [1][3]*

At the POS system, data of each transaction needs to be read, extract individually and send to server. Hence, to create a digital receipt, server will sort out data accordingly and generate the digital receipt [1] [4]. After server has created the digital receipt in PDF format, the receipt signoff procedure will be triggered. In the process of digital receipt signoff, server will authenticate the content of the digital receipt before it sends the digital receipts to the recipients [1] [4]. The end destination that servers will send the digital receipt is usually to recipients' email address [3] [1] [4]. However, some digital service providers do send out the

digital receipts to their host websites and allow users to retrieve their digital receipt from the websites. The problem here is that servers play a huge role to facilitate the whole digital receipt delivery. Nowadays many retailers are not equipped with servers to store the business transactions data, especially the small business scale retailers. Asides from the large business scale retailers who possible have their servers in place, generic or small scale businesses will not necessary require servers for their businesses. Such scenario implies that digital receipt can only be implemented to big scale businesses that have their own servers. Small scale businesses that yet to have their servers will need to purchase server in order to implement digital receipt system and server nowadays are expensive. Moreover, retailers will need to hire specialists to set up the servers for them. These additional costs have hindered the retailers, especially the small scale retailer to make use of the digital receipt system. Due to the reason that most of the POS systems at retailers' place are commercial POS packages that usually do not integrate with digital receipt component (such as create and send digital receipt function), many retailers would not want to take the trouble to further modify their existing POS system for the use of digital receipt delivery. EDI (Electronic Data Interchange) is a middleware that will be installed in retailer's POS system and it will sit between external and internal computers to facilitate the exchange of messages [3][10].

2.2.2 Current Digital Receipt System Network Architecture

The following scope of study is the network architecture of the existing digital receipt system that commonly used by retailers. To set up full network architecture for digital receipt, networking hardware and multiple networking protocols need to be implemented. Retailers could have their Local Area Network or Wireless Connection to connect to their servers. Protocols that usually used for digital receipt system are HTTPS, HTTP and SSL. HTTPS is an Internet protocol that provides a SSL layer of security and uses both SSL and HTTP to protect the communication channel between the client and the server on a network [1]. SSL is designed to make use of TCP as a communication layer to provide a reliable end-to-end secure and authenticated connection between two points over a network (for example, between the service client and the server) [1]. The SSL protocol enables server and client authentication, and an encrypted SSL connection between a client and server [1]. mySQL is the common database management that works with PHP to serve the database management [1][10]. To set up such network architecture for Digital Receipt is never an easy task, not to mention the cost involved. Due to the high cost of server and its maintenance, some current digital receipt system suggests outsourcing all data management to a third party [3]. Although outsourcing could be a good alternative, retailers will still need to allocate a portion of expenses to pay off third party's services. The target of the author's approach is to totally eliminate the use of server in order to create a Light-weight digital receipt system for retailers.

28

The third scope of study is about the security measures of the current digital receipt system. Security is an important aspect in Digital Receipt System because it deal with data that shows customers' buying behaviours and some people expect such information to be unrevealed and kept protected. Some receipt might review customers' credit card information. The common five aspects that the current digital receipt system will place high emphasis are:

i.   *Specification of the communication protocol [1] [3]*

ii.   *Definition of goals, including the goals of the protocol and the adversarial goals [1]*

iii.   *Statement of assumptions, assumptions of the underlying problems, constraints of the user interactions, etc [1] [3]*

iv.   *Description of the protocol [1][3]*

v.   *Understanding of how the protocol meets its goals regarding security [1]*

2.2.3 Current Digital Receipt System Security Configuration

To assure the security at the server side, protocols such as SSL has been used for protection of data in transit in situations related to any network service and it is commonly used in HTTP server and client applications [1]. Besides, encryption is also often used to protect the

data. For example, the use of digital certificate has been used as a means of signature and validation. Digital certificates, which are analogous to physical credentials, can be presented as evidence of authenticity [1][9]. The digital certificate contains two types of key which are the public key and the private key [1][8]. Public key is used to decrypt the information which is previously encrypted by the private key [1][8][9]. It has become the responsibility of the retailers to set up a solid security measures for their servers once they host a server in house. Retailers would see such security complexity as an added burden for their business operations and therefore they would rather abandon the use of digital receipt and remain using on paper receipt since paper receipt helps to waive off just all the complications.

2.3 Data Extraction at the Printer Environment

The author managed to figure a method to combine different applications that enables receipt data extraction to happen at the printer environment, rather at the backend environment. The following are the few applications that the author used to extract the receipt data from the printer environment.

2.3.1 AutoIt

2.3.1.1 Functionalities of AutoIt

In its earliest release, the software was primarily intended to create automation scripts for Microsoft Windows systems but has since grown to include enhancements in both programming language design and overall functionality [10]. With the release of Version 3, the syntax of AutoIt has been restructured to be more like the BASIC family of languages. It is a third-generation programming language using a classical data model, utilizing a variant data type that can store several types of data, including arrays. It is compatible with Windows 95, 98, ME, NT4, 2000, XP, 2003 and Vista (however, support for operating systems older than Windows 2000 was discontinued with the release of v3.3.0)[12].

2.3.1.2   Rationale for Using AutoIt

The reason of using AutoIt is because 90% of the POS systems nowadays are using Windows as their main operating platform. [9] AutoIt can serve to build interaction script to command POS system to capture receipt image from the receipt printer and also to send the digital receipt across. Though the application created by AutoIT will not be able to operate at other POS systems that use other types of operating platform such Linux and Ubuntu, the author believes that the proposed system is still marketable and able to obtain high market share since most POS system today are using Window as their operating platform. [9]

2.3.1.3   AutoIt Features

 i. The AutoIt SciTE editor.

 ii. Scripting language with BASIC-like structure for Windows Desktop Environment.

 iii. Add-on libraries and modules for specific applications.

 iv. On-line support forum for AutoIt users and developers.

 v. Supports TCP and UDP protocols.

 vi. Supports COM (component object modelling) objects.

 vii. Call functions in Win32 DLLs.

viii. Run console applications and access the standard streams.

ix. Include files in the compiled file to be extracted when run.

x. GUI interfaces, create message and input boxes.

xi. Play sounds, pause, resume, stop, seek, get the current position of the

xii. Simulate mouse movements.

xiii. Manipulate windows and processes.

xiv. Automate sending user input and keystrokes to applications, as well as to individual controls within an application.

xv. Scripts can be compiled into standalone executables.

xvi. Unicode support from version 3.2.4.0.

xvii. 64 bit code support from version 3.2.10.0.

xviii. Supports regular expressions.

xix. Works with Windows Vista's User Account Control.

xx. Object oriented design through library

2.3.1.4 Limitations

AutoIt is single threaded which makes asynchronous programming, concurrency and parallelism (e.g. communications applications) extremely difficult. (This can be worked around through the use of such things as

multiple processes, Component Object Model etc. but it would be much less onerous if a multithreading API was provided for in the language itself or its libraries.) AutoIt applications sometimes get a false positive report from virus scanners using heuristics, because the application is a self extracting executable. [12]

2.3.2 doPDF

2.3.2.1 Functionalities of doPDF

DoPDF is a proprietary Portable Document Format converter/editor for Microsoft Windows developed by Softland Software. It is completely a freeware and charge no fee upon the service provided. The developers also produce doPDF Writer (formerly Printer), a plug-in application which acts as a "printer subsystem" to enable Windows applications that have print capability to output documents in .pdf format. [11]

2.3.2.2 doPDF

The most highlighting feature of the proposed system is actually to extract receipt image from POS printing environment, particularly at the receipt printer, rather

than accessing the POS database or back-end environment to extract receipt data. DoPDF PDF printer is a proprietary freeware application for converting documents into Portable Document Format (PDF) from any application running on Microsoft Windows operating systems that can print, similar to the free software PDFCreator [11].

2.3.2.3   doPDF Features

The doPDF Printer works by creating a virtual printer in the operating systems that prints to PDF files instead of paper. This practically allows any application to create PDF files from the print menu. The virtual printer employs Ghostscript in order to translate the document into the Portable Document Format. [11] Since such application is free and the author believes that it could help to achieve the Light-weight goal as proposed earlier. doPDF will ultimately help to convert image captured from the printing environment and convert it into PDF files. The converted PDF file will be attached at the Appendix section for further reference.

2.3.2.4   Securities of PDF file encryption

The key feature of this software is its ability to password protect PDF files during creation with 128/40 encryption.[13]. Therefore, the password protect feature has provided security assurance for the digital receipt created especially during the transmission. The PDF file is encrypted well throughout the processing.

2.4   Marketability of the Proposed Digital Receipt System in Malaysia

Recent survey conducted by Malaysian Communications and Multimedia Commission shows that 84.4% of them are using GPRS to access the Internet via their mobile devices. 3G subscribers in Malaysia are also increasing from 155.5 million in 2007 to 436.6 million in 2008. Now that Malaysia already introduce WiMAX and appointed four network operators to contribute on WiMAX development in Malaysia, it is targeted that this 4G technology will cover 25% of the population in Peninsular Malaysia by the end of 2008, increasing this to 35% and 46% in 2009 and 2010 respectively [15]. This survey shows that Malaysian is well prepared to embrace the digital receipt technology already. With a high percentage of households having the internet connection, they can now receive digital receipt from their email any time and at any moment. The timing for a Light-weight digital receipt system

implementation in Malaysia market is just right and the author aims to obtain a positive response from the local as well as the global market.

2.5   Cancerous Thermal Paper Receipt

The author realised it is necessary to address a critical issue after carrying out the researches. Thermal paper is not recyclable, therefore all of it goes directly to landfills. Besides, thermal paper is coated with BPA (bisphenol-A). Developed as an estrogen replacement, BPA is widely used to line metal cans and in thousands of other household products, including baby bottles, eyeglasses and CDs. It has been detected in nearly all Americans tested. BPA is an endocrine disruptor, which can mimic the body's own hormones and may lead to negative health effects especially when exposure occurs in early development. Many states have banned BPA in infant formula containers, baby bottles, and sippy cups. Earlier this year, The Endocrine Society released a scientific statement expressing concern over current human exposure to BPA. Research has linked BPA to prostate and breast cancer, obesity and diabetes, early puberty ovarian cysts and uterine fibroids, reduced fertility and miscarriage [18] Therefore, this has further strengthen the purpose of developing and implementing digital receipt to substitute the use of thermal paper receipt.

CHAPTER 3: METHODOLOGY OF STUDY

The project adopts an agile system development life cycle and is segmented into five main phases. Phase 1 mainly involves research work. Phase 2, 3, and 4 make up the main development stages. Agile development is chosen to accommodate requirements changes and frequent adaptation to alternative designs and revised models. The developed modules from the iterations will be evaluated; inspected and further enhancements will be made, if needed. The agile methods could align the development of the proposed optimization technique with academic standards. Finally, phase 5 will be testing, evaluate, and further enhancement.

3.1 Phase 1 – Planning, Creating System Business Logics and System Analysis:

The first phase of the project development will be planning, creating system business logics, and system analysis. Planning is to define all information that is required to make the project successful. This project is developed within one-year time so that functionalities of the project are limited to certain requirement only. System business logics are the study of the important of the project in the real business world. Business logics might be changed to certain of time; therefore, the software development should be flexible enough to cope with the business logics. System analysis will be focus more on use-case diagram.

3.2   Phase 2 – Building System Libraries and Functionalities:

Functionality development can be called as Application Layer in
AutoIt technology. In this phase, the core functionality is to retrieve
digital receipt from the printer which is installed with the POS system
(instead of retrieving from server). Such functionality will be
developed using AutoIt, a modern programming language that
commonly used to interact with systems. Therefore, printer is now the
author's target spot to gather data, but the server. This functionality
need to be done without needing the retailer to reconfigure its POS
system at all. AutoIt will capture all the content in the receipt and
convert it into PDF file. AutoIt will encompass a huge library of
interactive tools to bridge the POS system without altering any the
architecture of the POS system.   Cute PDF, a free source system is
expected to convert captured digital receipt into proper PDF file.
AutoIt will also automate the process of sending the digital receipt in
PDF format to customer's email address.

3.3   Phases 3 - Design and Develop System Graphical User Interface:

In the phase, system construction tasks such as writing sources codes and
designing interfaces will be started. Prototypes and mock systems will
consistently be developed to test for its operability, functionalities, security,
and user's satisfactions. AutoIt will be the major tool used to construct the
system. The author will use AutoIt as the development platform which
utilizes C++ language as its development language. Graphical User Interface

will be developed as soon as the functionalities are all fully constructed and well tested for its operability.

3.3.1 Creativity vs. Consistency

Creativity gives opportunity to developers to design a unique system that is attractive, striking, and eye catchy user graphical interfaces. Consistency wise refers to the ability of the developers to produce the user interface which is very much similar formatting like the generic systems in the market [14]. Such similarity creates consistency for users as they already familiar about the interface. Developers may have their own ideas on designing the application, but it is a good step to include some of the features used by other application since user can reuse the technique that they have learned to get familiar with the new application [14]. Thus, developers need to be consistence with the standard interface guidelines.

3.3.2 Navigation

To create the best navigation system, the main target to achieve is to achieve simplicity, and reduce complexity. Application should reduce the number of screen to be navigated in order to view the desired information. The structure of the application should be simple and eliminate the use of many submenus. User should also be able to recognize a main screen in order for them to know the starting point. Navigation to all parts of the

application should be placed in the main screen and links to the main page should be place in most screen of the application.

3.4 Phase 4 – System Integration and Implementation:

After digital receipt retrieval and graphical user interface are built, these two main components will be integrated as a web based system. Wireless will link remote users from different ends and send digital receipt from POS to the customer.

3.5 Phase 5 – Testing, Evaluate, and Further Enhancement:

This is the final stage of the project. In this phase, developers need to do testing and performance matrix of the system. By doing so, the project can be evaluated, and further enhancement will be taken into consideration.

CHAPTER 4: RESULT AND DISCUSSION

4.1 Phase 1: Planning Deliverables - Business Logics and System Analysis

4.1.1 Identify Business Logics and Business Requirements for System Development

The context of business logic mentioned here refers to how the system supposed to be developed in order to achieve profitability in the market and also gain good positive response from the retailers. Digital receipt system has existed for long since the year 2000. According to the literature review above, the need for digital receipt system still exists in the market especially when the global concept of green technology has becoming more significant nowadays. Researchers have shown that several business logics are expected to be considered in building a better digital receipt system to encounter the current problems of the current existing digital receipt system in the market. These business logics are as following:

No	Requirements	Business Logics
1	Simple Implementation and Installation at POS point [1]	• Business operations will not need to be shut down for installation and implementation. Installing can be done within a short period of few minutes (maximum time required:

		1 hour)
		• Losses can be avoided for not shutting down the operations
		• Installation procedure is thus simple even the retailer themselves can install the system into their POS system
2	Avoid any modifications on retailers' POS system/ Avoid access into retailer's database [1]	Retailer will not need to expose to the system for outsiders to modify: • Privacy of business information can be protected • Business operations will not need to be shut down for installation and implementation. • No problem regarding user requirements raised by the modifications will happen
3	Implementation cost needs to be as low as possible [3]	• Low implementation cost will greatly attract retailers to give a try to the proposed system • No extra costs need to be allocate for the use of the system •

4	Eliminate the use of servers [1]	• Help retailers to eliminate cost of setting up a new server • Retailers will not need to hire network specialist to implement server protocols • Eliminate the cost and trouble to maintain the server

Table 3: List of Requirements and Business Logics for System Development

4.1.2 Develop System Architecture and Framework

Retailer's POS

Customer's Mobile Phone
- Receive Alert Tag from POS
- Claim from Retailer using Alert Tag as proof if Digital Receipt is not received

INTERNET

Retailer
- Download Digital Receipt system executable file
- Install the Digital Receipt System into POS
- Obtain customer's barcode (represent customer email address)
- Scan the barcode into the Digital Receipt System
- Press the Digital Receipt Creation button
- Press the store digital receipt button
- Press the send button
- Send Alert Tag to Customer's Mobile Phone

Customer's PC

Public Server

Customer
- Create personal email address barcode from barcode generator website
- Present barcode when customers need a digital receipt
- Log in to personal email and retrieve digital receipt

Public Server
- Store Digital Receipt
- Transmit digital receipt from POS to customer

Figure A: Light-Weight Digital Receipt System Framework

45

Above is the proposed system architecture from customer's point. The architecture framework is made up by several elements as below:

Website:	A website needs to be built to help customer to convert their email address into barcode. The purpose of such conversion is to avoid mistake entering customer's email at the POS point and also to save time by just scanning the barcode by a bar code reader.
Customer:	Customer will need to access to the website setup by the author to convert their email addresses into barcodes. When they approach the retailer's counter and wishes to request for the digital request, they need to present their barcode and retailer needs to retrieve such their email (in barcode form) through a bar code reader
Barcode reader:	To help retailer to retrieve customer's email address correctly
POS System:	The targeted retailer is expected to have their on POS system in place. The POS system should be implemented in Windows operating platform. The system will capture receipt image from the POS' printing environment

Host computers:	Host computer here is where the POS and the proposed system are installed.
Wireless networks:	Wireless communication capability supports mobility for end users in mobile commerce systems. If wireless network facility is available at retailer's place, digital receipt will be sent using it
Wired networks:	Most retailers' computers (servers) usually reside on wired networks such as LAN. If wired network facility is available at retailer's place, digital receipt will be sent using it
Public Servers:	This proposed architecture can be considered cost –effective because no servers need to be setup. Public servers that provide free storage and transmission services are used. The public servers are, for example Gmail, Hotmail or Yahoo servers.
Mobile Devices:	An Alert Tag will be sent to customer for every digital receipt received at the end of a purchase transaction

4.1.3 Develop Network Architecture and Framework

Point-of-Sales System

Customer's Mobile Phone

Public Server

Printer Environment

Customer's PC
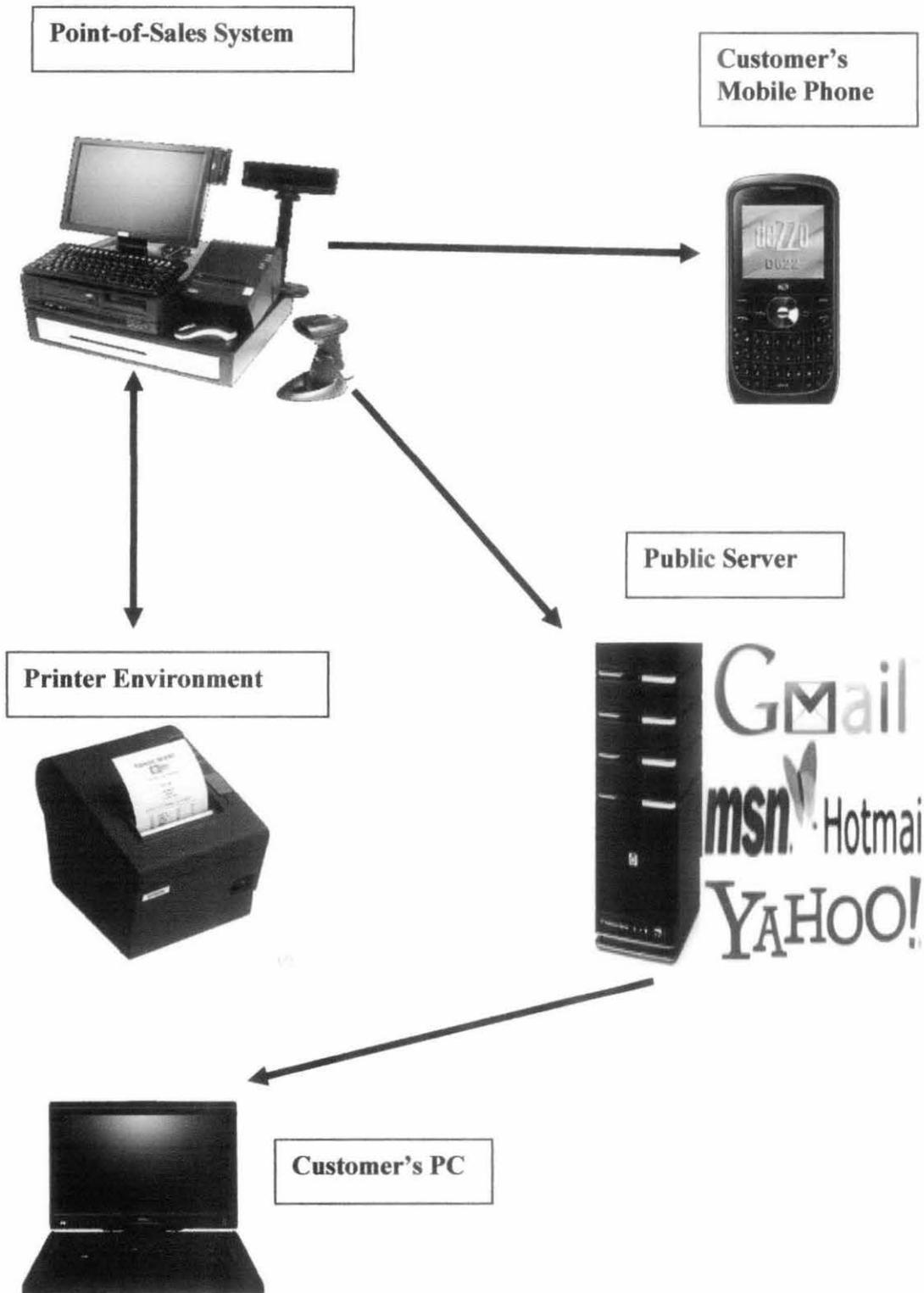
Figure O: Light-weight Digital Receipt Network Architecture

4.1.4 Develop Prioritized System Requirements List (PRL) using MoSCoW approach.

The author has adopted the MoSCoW approach to sort out the system logics and requirements according to its level of criticality and importance. The following list is made up based on MoSCoW approach. The "Must" requirements are non-negotiable, if they are not delivered then the project is a failure. Nice to have features are classified in the other categories of "Should" and "Could". Requirements marked as "Won't" are potentially as important as the "Must" category. "Won't" acknowledges that it is important, but can be left for a future release [13].

M - MUST have this.	Capture Retailer's email
	Capture Customer's email: System should be able to read customer's email via bar reader
	Grant each retailer with a public email account
	Capture receipt information at printer's environment
	System should allow POS system to either send paper receipt or digital receipt
	Covert receipt into PDF format
	Attach receipt in the email and sent to

	customers' email destination
	Alert the retailer the status of digital receipt delivery
	View receipt delivery history
S - SHOULD have this if at all possible.	The proposed system is only capable of capturing receipt in image format. The proposed system should be able to extract the specific data in the receipt as well.
	The system proposed currently can only be installed in Window-based platform POS system. The author will strive to enable the proposed system to be installed in every possible POS operating platform.
C - COULD have this if it does not give effect on anything else.	Digital receipt can also be sent to customer's mobile devices
	Digital receipt sent out should be attached with advertisement or market promotion – source of additional revenue

W - WON'T have this time but would like in the future.	Data mining to observe customer's buying behaviors

Table 4: Prioritized System Requirements List using MoSCoW Approach

4.2   Phase 2: Building System Libraries and Functionalities

4.2.1 Identify Non-functional Requirement

Usability

- The top most emphasis is on the simplicity of the overall system, since we expect the users to be retailers and customers that might be computer illiterate.

- The system need to be user friendly

- Adherence of the interaction objects (menus and buttons) to well-known standards.

Performance

- Since this system is residing at the retailer's counter environment, speed is a great concern. Customers and retailers will expect the payment procedure to be done as quickly as possible. The system must operate as fast as possible if customers request for digital receipt.

- If the delivery of digital is failed, the retailer must be alert at once. In the event of system failure, alert messages should be displayed to tell retailer how to fix it.

4.2.2 Develop and Build Iteration

Specifications about the system iteration will be used as a guide for system development as the user's actions, data needed, navigational components and the screen sequence can all be identified. It helps to define components in system libraries and give a large picture about the overall system architecture. The deliverables for this stage are a Design Model and Prototype. Design Model will consist of the following analysis diagram:

- **Data Flow Diagram**
- **Class Diagram**
- **Use Case Diagram**
- **Sequence Diagram**

4.2.2.1   Analysis Model: Data Flow Diagram

(Figure B: Light-weight Digital Receipt Data Flow Diagram)
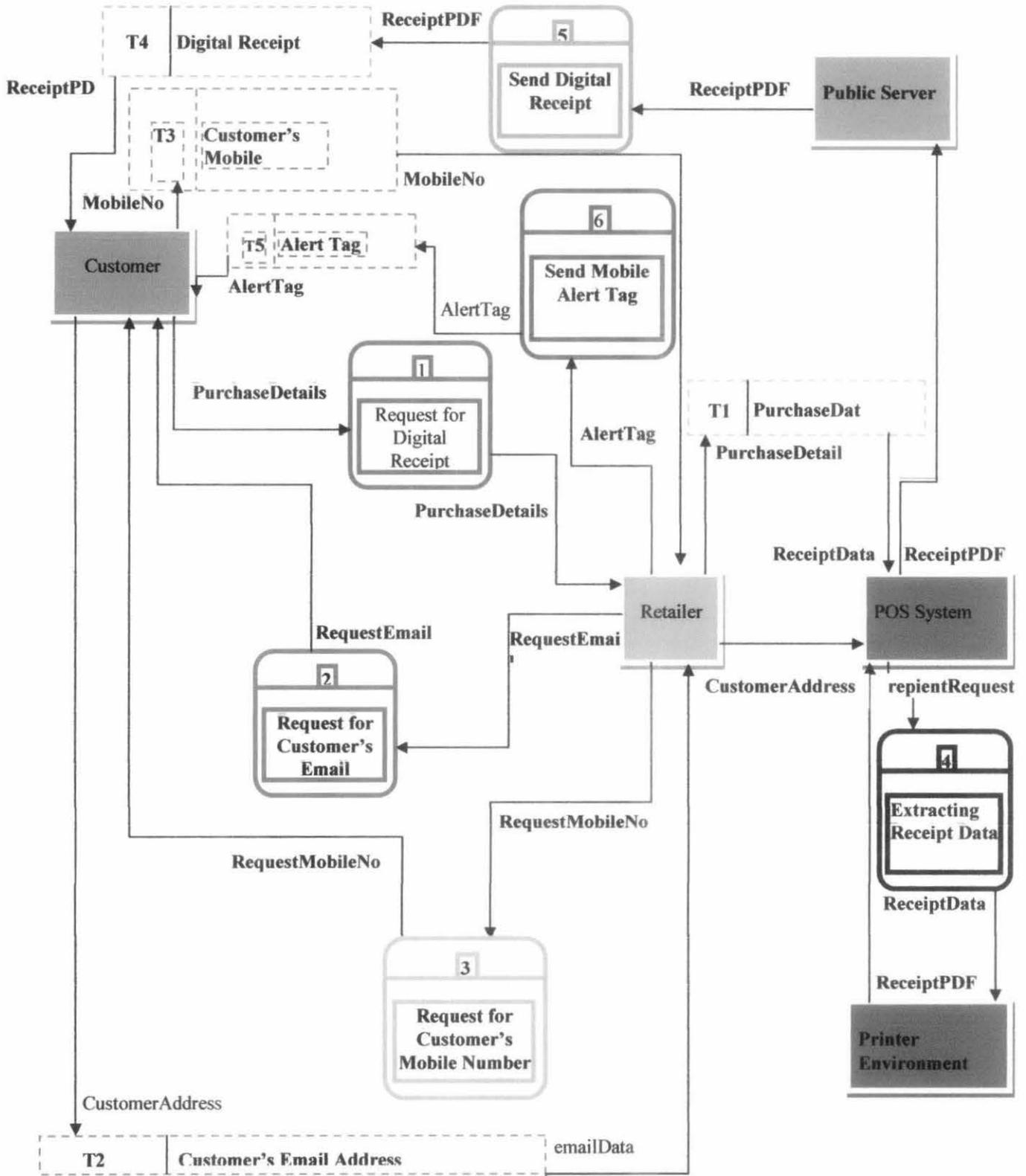
4.2.2.2   Analysis Model: Class Diagram
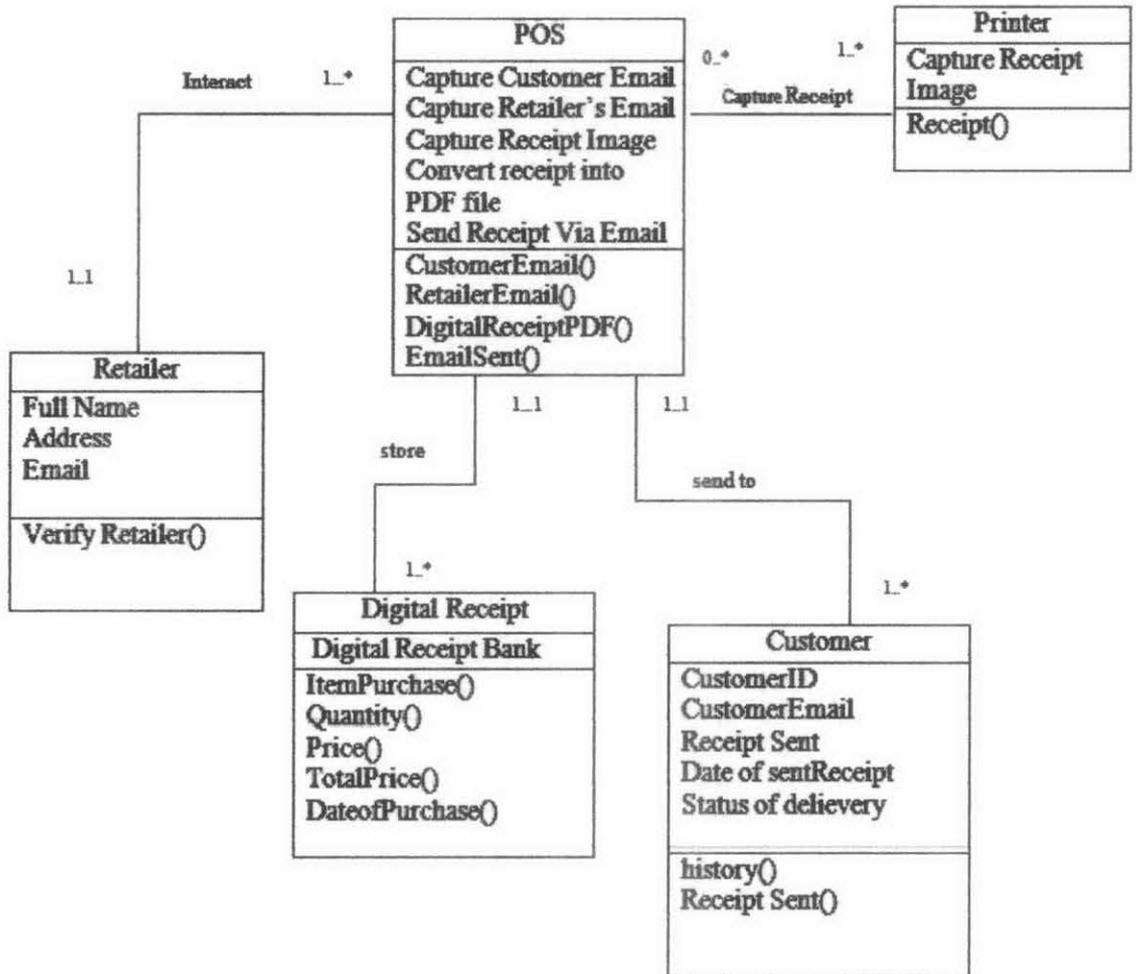
Figure C: Light-weight Digital Receipt System Class Diagram

4.2.2.3   **Analysis Model: Use Case Diagram**
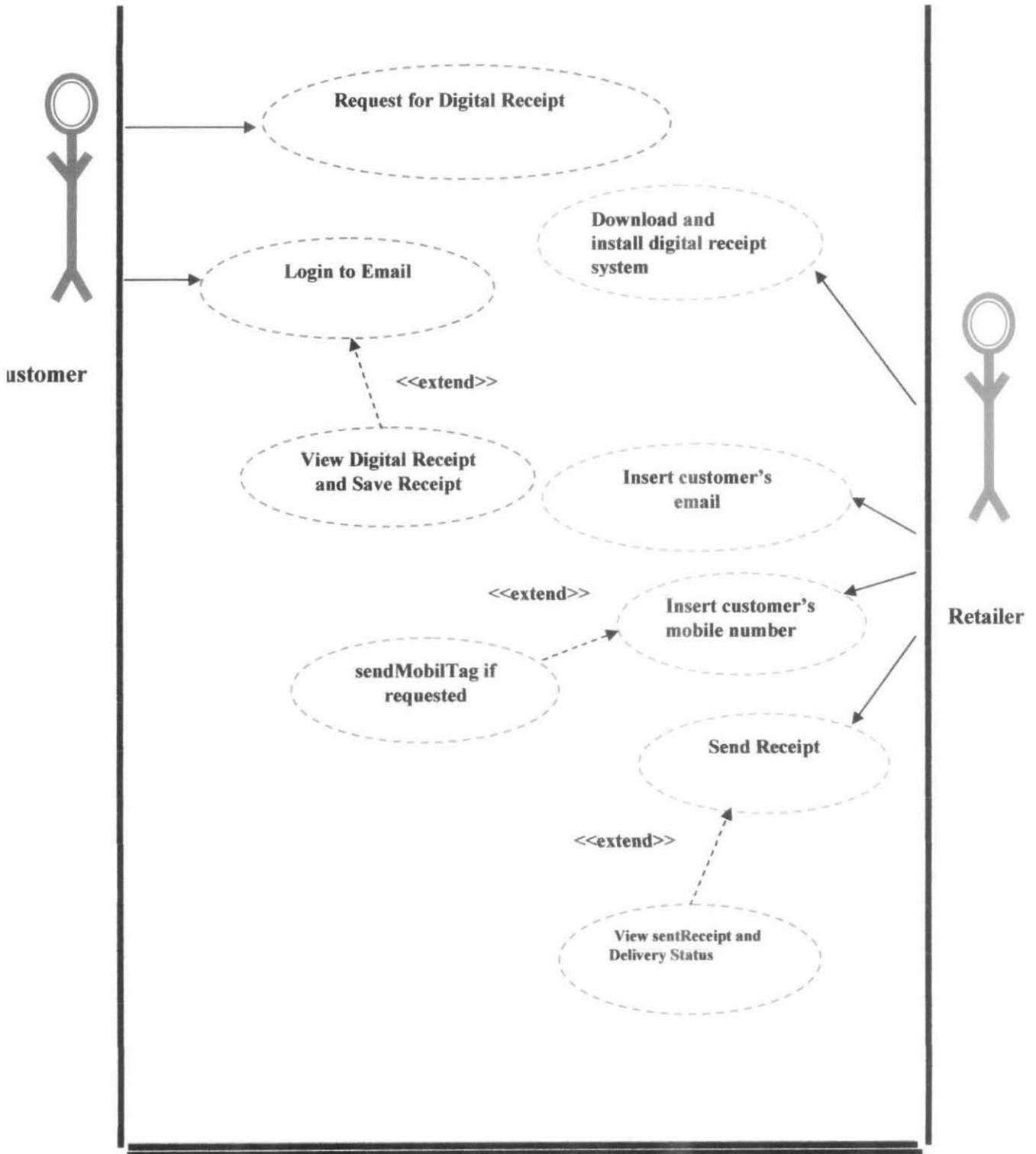
Figure D: Light Weight Digital Receipt System Use Diagram

4.2.2.4   Analysis Model: Sequence Diagram
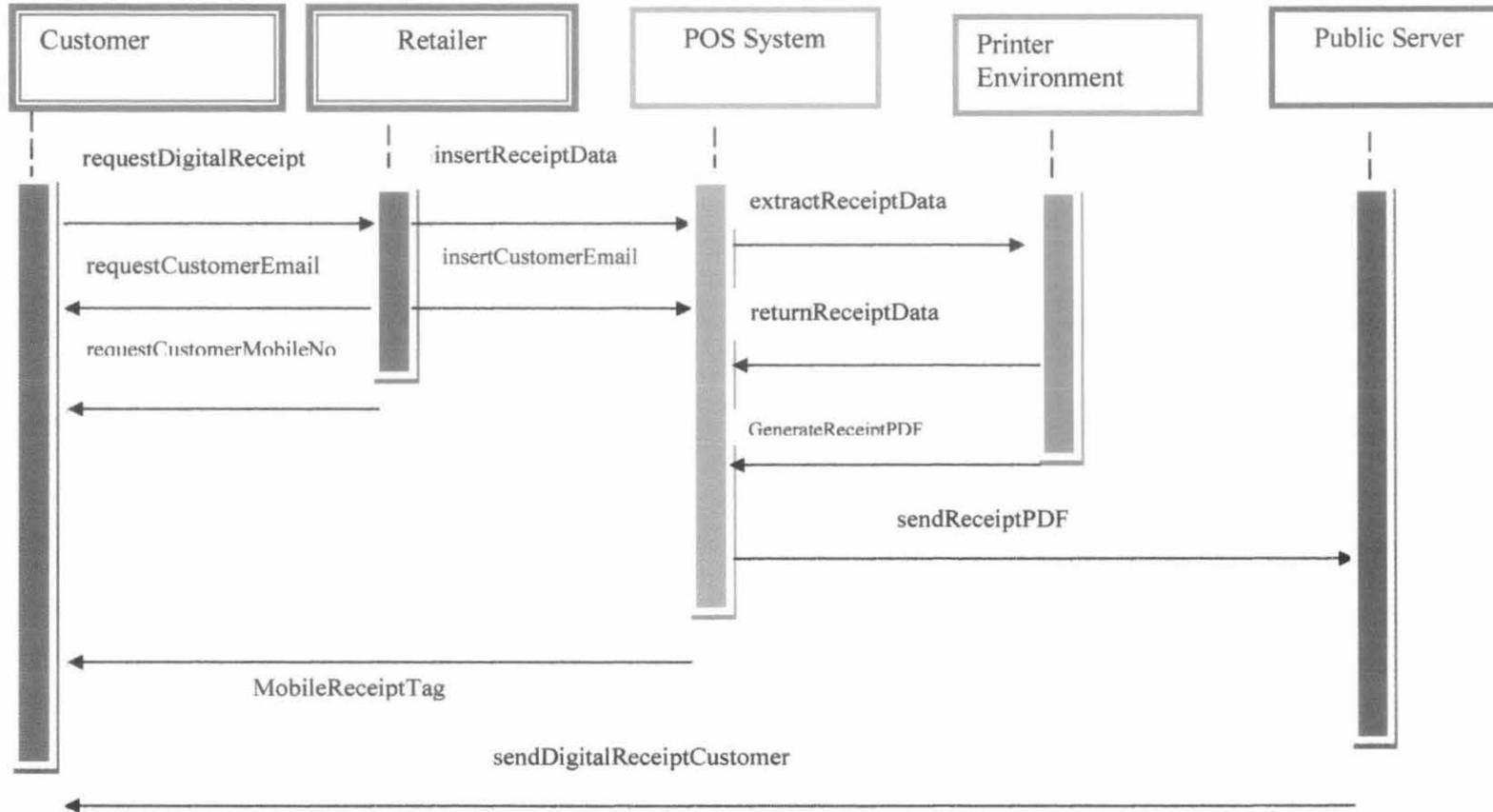
Figure E: Light-Weight Digital Receipt System Sequence Diagram

4.3 Phase 3: Design and Develop System Graphical User Interface

In this particular phase, an executable system will be constructed using AutoIt as the development platform. The executable system will be installed in retailer's POS system and the designated size for the executable system will only be as small as 20 KB. The executable system will not interfere with the operations of the POS system and can easily be removed without causing any harm to the POS. Strictly adhere to the requirements stated in phase 1 and phase2, the functionalities of the executable system will be constructed stages by stages as stated below:

i. Identify and Capture Printer Information

ii. Prompting for Casher's Email Address and Information

iii. Prompting for Customer's Email Address

iv. Setting File Directory to Keep Sent Receipt

v. Setting Network Configuration

vi. Creating Hotkeys

vii. Alternate Switch between Paper Receipt Mode and Digital Receipt Mode

viii. Commanding doPDF

Thus far all the basic functionalities are already developed and the author will continue to test the operability of all these functionalities to ensure high level of accuracy.

4.3.1   Executable System Development for POS system

4.3.1.1 Identify and Capture Printer Information Module

As the core idea suggested by the author about the new digital receipt system, the information of the receipt will not be captured at the POS back-end environment, but at the printer environment. Thus, the executable must identify the printer that the retailer's used to connect with the POS system and build connection with it. The executable system must also be able to manipulate the printer so that the information sent to the printer buffer can be captured and recorded in PDF format.
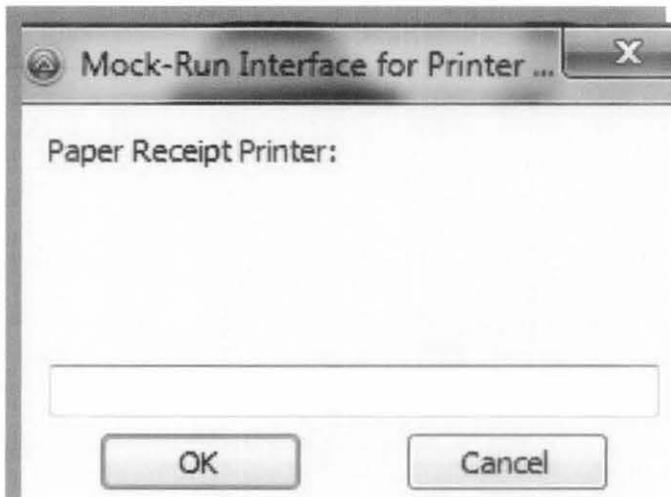
Figure F: Mock Interface to Capture POS Printer Information

4.3.1.2   Prompting for Casher's Email Address and Information Module

To send email to customer, retailer must acquire his or her own email address, which is probably a general email address from Gmail or Hotmail. That email address will serve permanently as the receipt sender

to customer. Therefore, information about the receipt sender email address need to be pre-set beforehand.
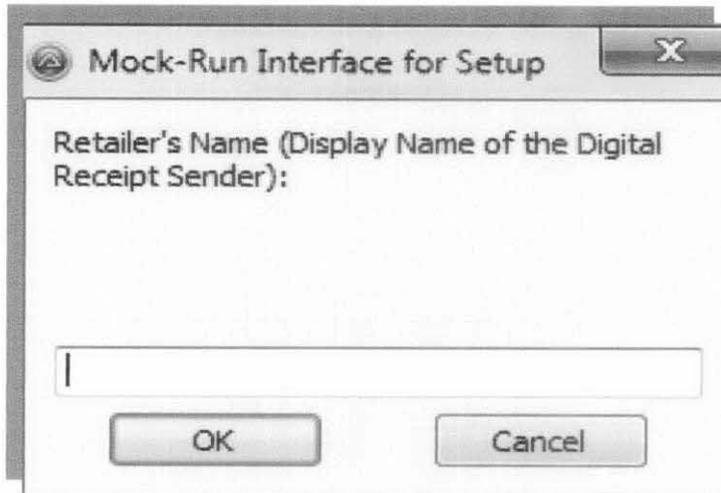
Figure G: Mock Interface to Capture Retailer's Name
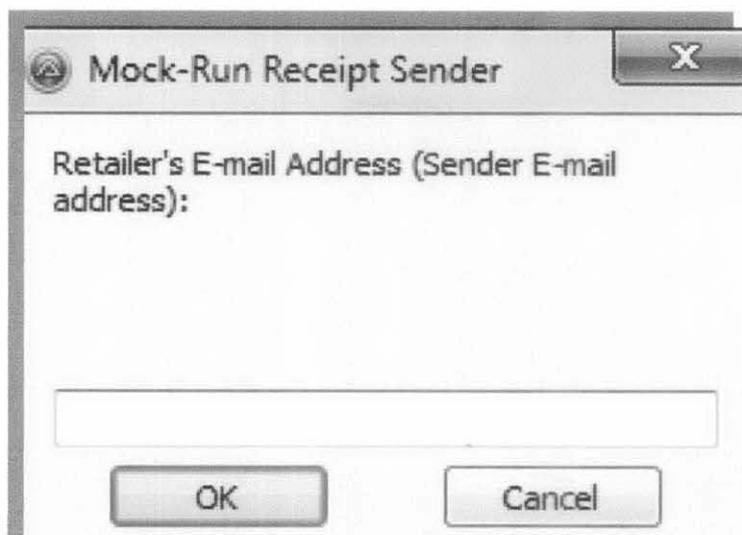
Figure H: Mock Interface to Capture Receipt Senders Email

Figure I: Mock Interface to Capture Receipt Sender's Password

4.3.1.3   Prompting for Customer's Email Address Module

The executable system must be capable of prompting the retailer's to insert the customer's email address so that system can forward the PDF receipts to the customer.
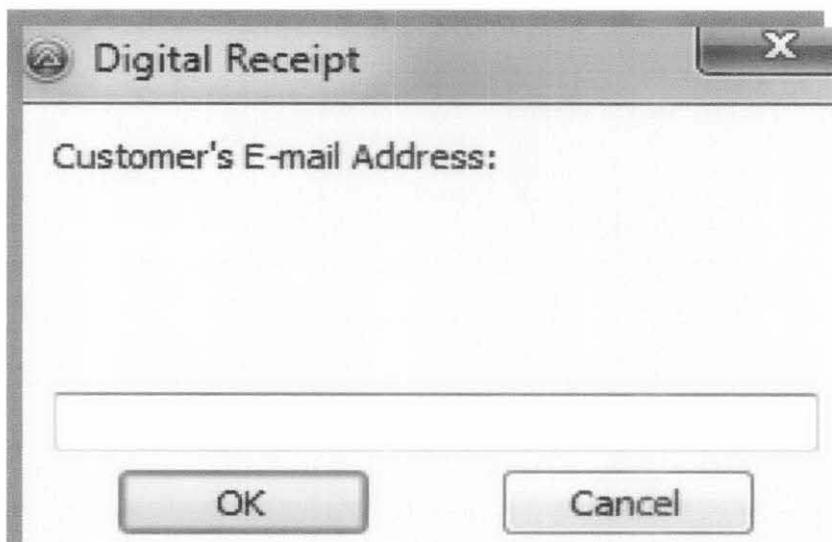
Figure J: Mock Interface to Capture Customer's Email Target

4.3.1.4   Setting File Directory and Keep Sent Receipt Module

For some of the information that captured, such as printer's information, receipt sender email and password need to be kept as historical data so that casher will not need to repeatedly insert this information whenever they use the system. The system must be capable of generate an .ini file that can help to keep all these information.

Figure K: Directory to keep sent receipt

4.3.1.5   Setting for Network Configuration Module

Different retailer might have different network setup, and the executable system must be able to provide flexibility for retailer to configure the network setting if necessary. For example, the system can allow retailer to configure the IPPort setting, SMTPserver, IP address, and subnet mask.

4.3.1.6   Creating Hotkeys Module

Hotkeys are the short cut keys for the casher to press on the POS keyboard, and these Hotkeys are basically used to ease task of the

casher. By using the Hotkeys, the casher does not need to take time navigating the system to capture information. The cashers can simply press a few Hotkeys and the command wanted will automatically be triggered according to the hotkeys pressed.

4.3.1.7   Alternate Switch between Digital Receipt Mode 1 and Paper Receipt Mode Module

The executable system must also provide the ease and flexibility for the retailer to switch to either using the conventional paper receipt or to use the digital receipt. If the customer requires a paper receipt, the executable will switch to printing paper receipt mode, and conversely, if the customer demands for a digital receipt, the system will switch the mode to create a PDF receipt.
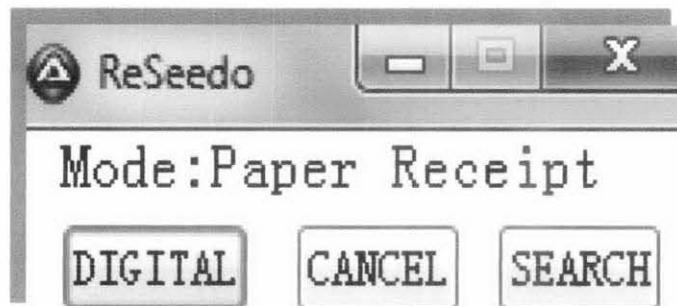
Figure M: Alternate Switch between Digital and Paper Receipt

4.3.1.7   Commanding doPDF Module

DoPDF is a freeware to help capturing information from the printer and creates PDF files. The executable system developed must be able to

command DoPDF to operate at the right time once the printer received information.

4.3.2 Developing Website for Generating Barcode from Customer's Email

A website has been developed for the purpose of directing customer a centre-point where they can generate their email address into barcode format. Requiring fellow customers to convert their email address into barcode format is particularly important because it assures absolute accuracy when retailer is inserting the customer's email for digital receipt transfer. The website will need to perform the barcode generating function at the first place. Therefore, the author has used the Drupal to construct the website. In the Drupal website, the author has made use of i-frames to import the barcode function from other websites. Besides, the website is will also provide link for the retailer to download the executable digital receipt system. Below is the website developed and is ready to be host.
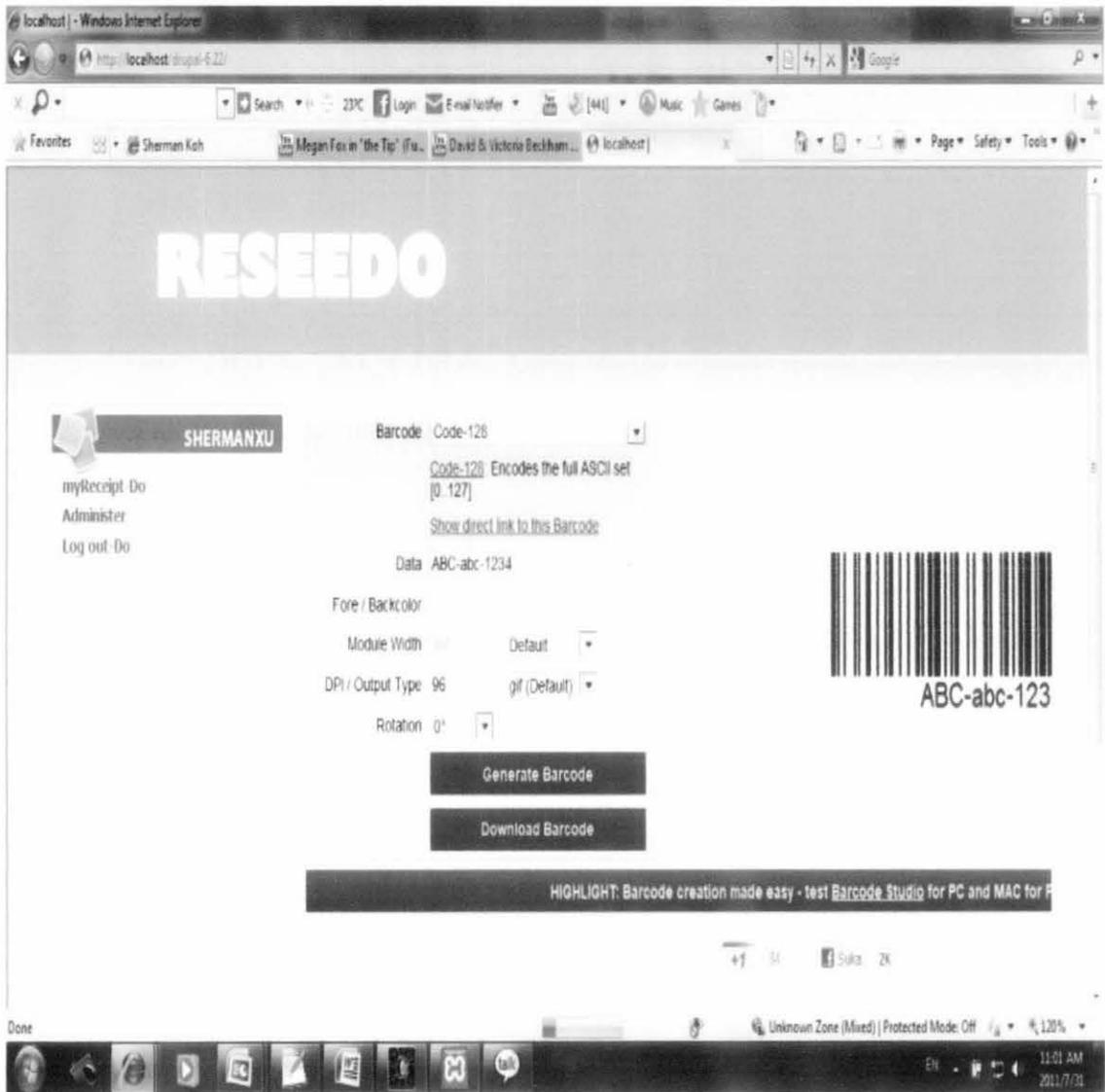
Figure N: Website to Generate Barcode Using Customer's Email

Address

4.4   Phase 4: System Integration and Implementation

System integration and implementation has started as soon as all modules and websites are well developed. This phase is conducted in a lab environment with a mock Point-of-Sales System installed at the lab PCs. To integrate the developed digital receipt system with the POS System (freeware), some tools are required to be in place, such as:

i.   POS Barcode Reader

ii.   Wireless Connection

iii.   SMS Modem

iv.   Email Address Generated in Barcode format. (Several different barcodes)

v.   Printer

The system integration and implementation process is conducted in the following manner:

START: Download and install different versions of POS system (freeware) in lab's PC

↓

Plug and play the barcode reader and test its usability

↓

Switch on wireless connection in the lab

↓

Install light-weight digital receipt in the same PC

↓

Log on to the website developed to generate barcode from email address

↓

Print the generated barcode

↓

Create a public email for retailer, using gmail, hotmail or yahoo (Create a sender's email)

↓

Log in to sender email address

↓

Log in to recipient email address

↓

Execute the light weight digital receipt system that install previously; insert all the required information such as printer details, sender's email, customer's email, and promotion details and so on.

↓

Minimize the light weight digital receipt system

↓

Execute the installed POS system (freeware)

↓

Conduct a mock cashier-buyer scenario:

1. Gather Customer's Purchase Transaction Details
2. Observe Customer's Request for Digital Receipt or Paper Receipt
3. Switch the system mode:
   i. If digital receipt → Press Digital Receipt Mode
   ii. Else → Remain Paper Receipt Mode
4. Request for Customer's Email Address
   i. If Customer has a email barcode → scan barcode
   ii. Else → Insert Customer email address manually
5. Enter Print Option and allow printer to gather environment
6.
7. Generate Receipt in PDF format from printer environment
8. Send Digital Receipt generated in PDF format

END

The integration and implementation process has been conducted repeated to test on the system operability and also to identify possible bugs and errors. Errors and bugs are reported and will be further discussed in the upcoming phase. The overall implementation process is satisfying and the system has integrated very well with different POS systems (freeware), which are namely:

i)   POS 4 Business
ii)   TurboCash
iii) COOPER
iv)   Agnitech POS
v)   UBS POS

Many digital receipts were generated throughout the implementation, and below is the image of digital receipt generated.

Pak Ali's Warung
1, Jalan Istimewa, Kota Damansara, The Curve
012-3454544

Receipt

Qty	Item Code	Description	Unit Price	Total
1	9595570312131	100 Plus Minuman Isotonik	RM2.50	RM2.50

Sub total	RM2.50
Total Amt Due	RM2.50
Amount Tendered	RM5.00
Change	RM2.50

Figure P: Sample Digital Receipt Generated

4.4   Phase 5 – Testing, Evaluate, and Further Enhancement

Phase 4, which is system integration and implementation, has been successfully conducted in the lab following the sequence specified above. The developed modules in the system have proved to integrate well with each another and the system operated with a high accuracy in the lab environment. Some unforeseen bugs and errors have been identified during the implementation phase for example:

i)   Connection failure due to different port and secure socket layer

ii) Unable to terminate process when the system crashes

iii)Passwords for sender should in asterisk format

The above are the most severe errors and problems observed from the implementation process. The author has been working on the identified errors and some of them are successfully fixed but some are still on the progress to perfection. The debugging effort has been chart at below table:

Error/Bug/Problem	Cause	Status
i) Connection failure due to different port and secure socket layer	- Ports Number can differ depending on telnet, ftp, http, dns - SSL for http and https can be different depending on which one is used by retailer	Fixed - Assign the right number for each port for example, http:80, ftp 21, telnet 23 and so on. - SSL for https will be 1 and http will be 0
ii) Sender's Password should be in asterisk format	- Security Obligation	Fixed

Table 5: Bugs and Debugging Status

If there is enough time that allows further enhancements on the system, the author would like to try to the below features:

No	Possible Enhancement Features
1	Digital receipt can also be sent to customer's mobile devices - Send not only alert tag, but also send a copy of digital receipt through SMS (text limitation for SMS – very difficult) - Contact SMS providers such as Digi, Maxis and Celcom to seek for collaboration
2	Digital receipt sent out should be attached with advertisement or promotion about retailer's stores – source of additional revenue
3	Data mining to observe customer's buying behaviours

Table 6: Possible Enhancement Features

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The light-weight digital receipt system is now fully implementable in the lab environment with very high accuracy. To strive for further enhancements to better serve the market needs, the author will continue to observe possible improvement that can be implemented to the system. Although the system is now implementable, the alert tag transfer through customer's mobile phone will remain as a challenge because collaboration with SMS providers can only be executed only after this system is properly presented to the market. To convince the SMS providers for collaboration, an attractive business plan must be in place. Therefore, the next move is to focus on producing a solid and convincible business proposal to market the system. At the same time, the author will allocate significant time and money to conduct a series of market survey from time to time. This is particularly important because it helps to gather information about customers' preferences and feedbacks about the system in a timely basis. This information can help the author to strategize moves to improve the system from time to time. The author hopes that the digital receipt can be widely expanded around the global market and contribute a big part in saving the green environment. The author also will look forward to seek collaboration with governmental agencies in introducing the light-weight digital receipt system to the local as well as the foreign mark. The author believe that this light-weight digital receipt system can further expand its potential to the fullest in saving the green environment with the assistance from government agencies such as Department of Environment (DOE).

5.2 Recommendation

5.2.1 Conduct Further Market Analysis and Surveys

Though the system is now ready to implement, the author will still need to constantly conduct market research to gain further insights about customer's preferences, market requirements, industrial expectations, and retailers' points of views and so on. All these analysis are very important to prepare the system in its best shape before promoting it to the real market. The author believes there are still many unforeseen or hidden problems that can only be discovered when the system is implemented in the real world. Thus consistent post-research and development will still need to be carried out from time to time to assure the high accuracy of the system operability.

5.2.2 Gain Recognition through Competition and Related Organization

To promote the authors system to the real market, the system itself will first need to be equipped with impressive testimonial and recognition from respected parties or organization. To gain recognition through competitions for the system is a very good step as these competitions do provide some level of evidence that proves the great potential and marketability of the system. The author will also seek for a good testing ground in the real market and offer free system testing in a high d in the real world. reputable company. If the system happened to prove its operability in such organization, it will further enhance the market confidence level towards the author's system.

References

[1] Inês Sofia Ferraz Moreira de Sá., *"Digital Receipts for Local Transactions in Commercial Spaces"* University Portucalensis, Department of Electrical and Computer Engineering

[2] Raymond R. Burke and E.W. Kelley Professor of Business Administration., *"The Digital Receipt: Bringing Together Online and In-store Shopping"* Kelley School of Business, Indiana University

[3] Eric Hawthorne., *"Digital Receipt Work Team Charter: ARTS-IXRetail Candidate Recommendation"* ARTS and IXRetail consortium, 11 January 2002

[4] Bruce Tognazzini and Palo Alto., *"The Digital Delivery of Receipt"* Sun Microsystems Inc. Woodside, California, 14 April 1998

[5] Marlene Zobayan. *"Enough Thermal Paper to Keep Us All Warm."* Consumer Change LLC, 02 February 2010 http://ezinearticles.com/?Enough-Thermal-Paper-to-Keep-Us-All-Warm&id=3687851

[6] Elsa Wenzel. *"Your receipt is in the e-mail."* CNET News Green Tech, 09 May 2008 http://news.cnet.com/8301-11128_3-9937567-54.html

[7] Elsa Wenzel. *"Your receipt is in the e-mail."* CNET News Green Tech, 09 May 2008

http://news.cnet.com/8301-11128_3-9937567-54.html

[8] Kyong Jun Lee, Jeong-In Ju, Jeong Mu Jeong, "A Payment & Receipt Business Model in UCommerce Environment", ACM International Conference Proceeding Series, Vol. 156, ACM 2006.

[9] Seeley, Nathaniel (Editor),"Digital Receipts: A System to Detect the Compromise of Digital Certificates", 2006.
http://contentdm.lib.byu.edu/ETD/image/etd1590.pdf

[10] Hao-Hsien Bobby Wang, "Desired Features and Design Methodologies of Secure Authenticated Key Exchange Protocols in the Public-Key Infrastructure Setting", Canada, 2004.

[11] *DoPDF, March 19, 2011*, Retrieved March 19, 2011 from DoPDF website, http://www.doPDF.com

[12] *AutoIt, March 19, 2011*, retrieved March 12, 2011 from AutoIt website, http://www.autoitscript.com/site/

[13] Mennecke, B. E., & Strader, T. (2001). Where in the World does location matter? A framework for location based services in M-Commerce. *Seventh Americas Conf. Information Systems*, (pp. 450-455).

[14] Ballard, B. (2005). *User Interface Design Guidelines for J2me Midp 2.0.* Retrieved August 20, 2009, from http://www.lulu.com/items/volume_1/97000/97087/2/preview/midp book1_1_preview.pdf

[15] Malaysian Communications and Multimedia Commission. (2008). *Communications & Multimedia Selected Facts & Figures.* Malaysia. Meier, J., Homer, A., Hill, D., Taylor, J., Bansode, P., Wall, L., et al. (2008). Chapter 19: Mobile Applications . In *Patterns & Practices: Application Architecture Guide 2.0.* Microsoft.

[16] Alletronic. (2009). *Frequent Asked Questions.*

[17]Mary Ellen Taylor, *Project Management*, Corey Csuhta, *Web Developer*, Lee Ourand, *Web Developer*, David Byrd, *Web Developer*, Emre Buyukayman, *Market Research*, Anthony Bailey, *Market Research*, "Quick Receipt", USA, December 13, 2010.

[18] Marlene Zobayan, *Enough Thermal Paper Receipt to Keep us All Warm.* Retrieved May 20, 2011, from http://ezinearticles.com/?Enough-Thermal-Paper-to-Keep-Us-All-Warm&id=3687851

Appendices

System Analysis and Design	Task	Gathering information to develop system model by doing system analysis and design
	Outcome	Develop use-case diagram, sequential diagram, interaction diagram, and other system analysis components.
	Time Frame	1 – 2 months
Develop System Software Component	Task	Develop software components based on object oriented design
	Outcome	Administration management, user management, database management, and other software modules by using AUOIT, DoPDF
	Time Frame	4– 6 months
Graphical User Interface Design	Task	Develop a presentation layer of the system
	Outcome	Friendly and interactive graphical user interface using HTML, Cascading Style Sheet, AUTOIT, Facebook Pluggings.

	Time Frame	1 = 2 months
Integration Between Graphical User Interface and Modules	Task	Making graphical user interfaces (Presentation layer) interact with AUTOIT modules.
	Outcome	70 or 80 percent complete system
	Time Frame	1 - 2 months
Setting Up System Platform	Task	Setting up server machine, server, and other software required.
	Outcome	Server platform that can be accessed by other computers.
	Time Frame	1 - 2 months
Implementing System on the Server	Task	To implement the whole system on the server machine
	Outcome	Be able to run the system from other computers
	Time Frame	2 months

System Testing and Evaluation	Task	Testing all system modules and classes
	Outcome	System response and performance matrix
	Time Frame	2 months
System Delivery	Task	Delivering complete system with documentation
	Outcome	Report/project submission.
	Time Frame	1 − 2 months

Date \ Task	Feb'11	March	April	May	June'11	July'11	Aug'11	Sep'11	Oct'11	Nov'11	Dec'11	Jan'12
System Analysis and Design	▓	▓	▓									
Develop System Software Component		▓	▓									
Graphical User Interface Design			▓	▓	▓							
Integration Between Graphical User Interface and Modules				▓	▓							
Setting Up System Platform					▓	▓						
Implementing System on the					▓	▓	▓	▓				

82

erver												
System Testing and Evaluation												
System Delivery												