

**DATA TRANSMISSION BETWEEN PDA AND PC USING WIFI
FOR POCKET BARCODE APPLICATION**

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*To my dearest parents, brother and sisters,
for their continuous love, motivation, support and encouragement.*

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ABSTRACT

Barcode system is a very common system that is widely used in various areas in today businesses. Pocket Barcode application will be another key evolution for barcode. Pocket barcode application that uses wireless network like WIFI is able to enable barcode to be captured anywhere and extract the information on the fly from server located somewhere else within the WIFI coverage area. Besides that, it can save computation time of Personal Digital Assistance (PDA) and at the same time utilize PDA (client) to communicate with PC (server) for more accurate information like inventory, delivery and pricing of stocks. The image captured by PDA is transferred back to server for processing and data extraction. In this project, client and server programming model was used to program the “Pocket Barcode Reader” client and “Pocket Barcode Server” applications. Actual data is transferred using WIFI network from client to server and vice versa through asynchronous socket. The asynchronous socket used transmission control protocol (TCP) to transmit data. Microsoft C# 2005 language was used to program both applications. Microsoft Windows Mobile 5.0 Software Development Kits was used to simulate “Pocket Barcode Reader” client application. The result obtained from this project is client program (Pocket Barcode Reader) that is able to transmit barcode pictures to server program (Pocket Barcode Server) for real time decoding. The decoded result is then transmitted back to client program for display.

ABSTRAK

Sistem kod bar merupakan sistem yang sangat biasa digunakan di merata tempat dalam dunia peniagaan hari ini. Penggunaan kod bar bergerak merupakan suatu kemajuan dan perkembangan terkini. Penggunaan jaringan WIFI membolehkan gambar kod bar diambil di mana-mana sahaja dan data mengenai kod bar ini dapat diproses dengan pantas selagi penggunaanya berada di kawasan jaringan WIFI. Selain itu, cara penggunaan sebegini membolehkan pembantu peribadi digit (PDA) menjimatkan masa pemrosesannya. Tambahan pula, PDA (Pelanggan) boleh memperoleh maklumat yang terkini daripada Komputer (Pelayan) seperti data simpanan, penghantaran barang dan harga. Semua ini dapat dilakukan dengan menghantar gambar-gambar yang ditangkap oleh PDA ke komputer untuk diproses dan datanya akan dihantar balik kepada PDA. Dalam projek ini, model pelayan-pelanggan (client-server) digunakan dalam mengaturcarakan “Pocket Barcode Reader” dan “Pocket Barcode Server”. Data dihantar daripada pelanggan kepada pelayan dan sebaliknya dengan menggunakan jaringan WIFI melalui soket. Soket pula menggunakan protocol penghantaran kawalan (TCP) untuk menghantar data. Aturcara kedua-dua program ditulis menggunakan bahasa aturcara *Microsoft C# 2005*. Perisian kit pembangunan *Microsoft Windows Mobile 5.0* pula digunakan untuk selaku program “Pocket Barcode Reader” yang berfungsi sebagai pelanggan. Keputusan yang didapati daripada projek ini ialah aturcara pelanggan (“Pocket Barcode Reader”) yang dapat menghantar gambar kod bar kepada aturcara pelayan (“Pocket Barcode Server”) untuk diproses. Data yang telah diproses akan dihantar balik kepada aturcara pelanggan untuk dipaparkan.

CONTENTS

| CHAPTER | TITLE | PAGE |
|----------------|--|-------------|
| | DECLARATION | ii |
| | DEDICATION | iii |
| | ACKNOWLEDGEMENT | iv |
| | ABSTRACT | v |
| | ABSTRAK | vi |
| | CONTENTS | vii |
| | LIST OF TABLES | xi |
| | LIST OF FIGURES | xii |
| | LIST OF APPENDIX | xv |
| | | |
| I | INTRODUCTION | |
| | 1.1 Project Background and Reviews | 1 |
| | 1.1.1 Barcodes and its type | 2 |
| | 1.2 Problem Statement | 4 |
| | 1.3 Objective and Scope of Project | 4 |
| | 1.4 Project Overview | 5 |
| | 1.5 Problems Challenges | 6 |
| | 1.6 Summary | 7 |
| | | |
| II | BACKGROUND AND LITERATURE REVIEWS | |
| | 2.1 Windows Mobile 5.0 and its SDKs | 8 |
| | 2.2 Network connections types and comparison | 9 |
| | 2.2.1 Bluetooth | 9 |

| | |
|---|----|
| 2.2.2 Infrared (irDA) | 10 |
| 2.2.3 WIFI | 11 |
| 2.2.4 Ethernet LAN | 14 |
| 2.2.5 Comparison table for Bluetooth, infrared, WIFI and Ethernet LAN | 15 |
| 2.3 Wireless Application Protocol (WAP) | 16 |
| 2.3.1 What is WAP? | 17 |
| 2.3.2 OSI Model for wireless communication | 18 |
| 2.3.2.1 Application Layer (WAE and WTA) | 19 |
| 2.3.2.2 Session Layer (WSP) | 19 |
| 2.3.2.3 Transaction Layer (WTP) | 20 |
| 2.3.2.4 Wireless Transport Layer Security (WTLS) | 21 |
| 2.3.2.5 Transport Layer (WDP) | 22 |
| 2.4 Wireless Access Point vs Adhoc Network | 22 |
| 2.4.1 Wireless Access Point Network | 23 |
| 2.4.1 Adhoc Network | 25 |
| 2.5 Development and Deployment: Tools, Emulators & Devices | 26 |
| 2.6 Summary | 27 |

III DATA TRANSMISSION USING WIFI

| | |
|--|----|
| 3.1 Pocket Barcode Reader Software Design | 28 |
| 3.1.1 High Level System Model | 29 |
| 3.1.2 Client module key features and functionality | 30 |
| 3.1.2.1 Pocket Barcode Reader Class Diagram | 33 |
| 3.1.2.2 ClientSocket Class | 35 |
| 3.1.2.3 Sending Image from Pocket Barcode Reader to Barcode Server | 38 |
| 3.1.3 Server module feature and functionality | 39 |
| 3.1.3.1 Pocket Barcode Server Class Diagram | 41 |
| 3.1.3.2 Server Socket class | 42 |

| | | |
|-----------|--|----|
| 3.1.3.3 | Sending ASCII code back to to Pocket Barcode Reader | 44 |
| 3.1.4 | Common module | 45 |
| 3.2 | Asynchronous socket connection | 47 |
| 3.3 | Summary | 48 |
| IV | SIMULATION ENVIRONMENT AND RESULT | |
| 4.1 | Simulation Environment Setup and Configuration | 49 |
| 4.1.1 | Windows Mobile 5.0 Emulator | 50 |
| 4.1.2 | Virtual Machine Network Service | 53 |
| 4.1.2.1 | Virtual Machine Service Installation and Verification | 54 |
| 4.2 | Deployment of Pocket Barcode Reader to Emulator | 58 |
| 4.3 | Simulation Result and Analysis | 58 |
| 4.3.1 | Pocket Barcode Reader Client Application | 58 |
| 4.3.2 | Pocket Barcode Server Application | 61 |
| 4.4 | Sample barcode images simulation | 65 |
| 4.5 | Summary | 69 |
| V | FUTURE WORKS, DISCUSSION, AND CONCLUSION | |
| 5.1 | Future works | 70 |
| 5.1.1 | Improvement on Pocket Barcode Reader | 70 |
| 5.1.2 | Improvement on Pocket Barcode Server | 71 |
| 5.1.3 | Overall system improvement | 72 |
| 5.2 | Discussions | 72 |
| 5.3 | Pros and Cons of Software Design | 73 |
| 5.4 | Summary and Conclusion | 74 |

| | |
|---|------------|
| REFERENCES | 75 |
| APPENDIX A POCKET BARCODE READER SOURCE CODE | 78 |
| APPENDIX B POCKET BARCODE SERVER SOURCE CODE | 92 |
| APPENDIX C COMMON MODULE SOURCE CODE | 103 |

LIST OF TABLES

| TABLE NO | TITLE | PAGE |
|-----------------|--|-------------|
| 2.1 | Bandwidth and range comparison between various connections types | 16 |
| 3.1 | Pocket Barcode Reader Application States and Error Code | 33 |
| 3.2 | ClientSocket class method and type | 37 |
| 3.3 | ServerSocket class method and type | 44 |
| 3.4 | Configuration class method and type | 46 |
| 3.5 | Network class method and type | 47 |
| 3.6 | Asynchronous methods used in ClientSocket and ServerSocket Class | 48 |

LIST OF FIGURES

| FIGURE NO | TITLE | PAGE |
|-----------|---|------|
| 1.1 | Sample of UPC, EAN, ISBN and 2D barcodes; (a) UPC barcode, (b) UPC barcode vE, (c) EAN-8 barcode, (d) EAN-13 barcode, (e) 2-D barcode, (f) ISBN barcode | 3 |
| 1.2 | Block diagram of proposed PDA and PC data transmission model | 5 |
| 2.1 | OSI Model of Wireless Application Protocol | 18 |
| 2.2 | Wireless AP device and its adapters | 23 |
| 2.3 | An example of wireless access point network model | 23 |
| 2.4 | An example of overlap access point to cover wider range and users | 24 |
| 2.5 | An example of ad hoc network model | 25 |
| 2.6 | Development and Deployment Environment, Tools and Devices | 26 |
| 3.1 | High Level System Model of Pocket Barcode Reader | 29 |
| 3.2 | Pocket Barcode Reader Startup GUI | 30 |
| 3.3 | Pocket Barcode Reader “Options” GUI | 31 |
| 3.4 | Class Diagram of Pocket Barcode Reader | 33 |
| 3.5 | Pocket Barcode Server GUI | 39 |
| 3.6 | Class Diagram of Pocket Barcode Server | 41 |

| | | |
|------|--|----|
| 4.1 | Mobile Devices Configuration page in Visual Studio 2005 | 50 |
| 4.2 | Windows Mobile 5.0 Pocket PC Emulator properties window | 51 |
| 4.3 | Windows Mobile 5.0 Pocket PC Emulator General Properties | 52 |
| 4.4 | Windows Mobile 5.0 Pocket PC Emulator Network Properties | 53 |
| 4.5 | LAN properties after installation of Virtual Machine Network | 54 |
| 4.6 | List of Windows Mobile Pocket PC devices | 55 |
| 4.7 | Pocket PC Emulator start up page | 56 |
| 4.8 | Pocket PC Emulator Network Setting Properties | 57 |
| 4.9 | Pocket Barcode Reader Options Form | 59 |
| 4.10 | Pocket Barcode Reader connecting to server | 60 |
| 4.11 | Pocket Barcode Reader Image file selection box | 60 |
| 4.12 | Pocket Barcode Reader load image and send to server | 61 |
| 4.13 | Initial start up of Pocket Barcode Server application | 62 |
| 4.14 | Pocket Barcode Server after connected to client | 62 |
| 4.15 | Pocket Barcode Server “Barcode” Tab | 63 |
| 4.16 | Pocket Barcode Server “ASCII” Tab | 63 |
| 4.17 | Pocket Barcode Server “Decode” Tab | 64 |
| 4.18 | Pocket Barcode Server “SendToPDA” Tab | 64 |
| 4.19 | Pocket Barcode Server “About” Tab | 65 |
| 4.20 | Various type of barcode images simulation | 68 |
| | (a) Glossy barcode | 66 |
| | (b) Distorted barcode | 66 |
| | (c) Distorted barcode | 66 |
| | (d) National Instrument barcode | 66 |
| | (e) blur barcode | 67 |
| | (f) Plastic surface barcode | 67 |
| | (g) Metal surface barcode | 67 |
| | (h) Dark surface barcode | 67 |

| | |
|--------------------------------|----|
| (i) Normal surface barcode | 68 |
| (j) Dirty surface barcode | 68 |
| (k) Reflective surface barcode | 68 |
| (l) Reflective surface barcode | 68 |

LIST OF APPENDIX

| | | |
|------------|-----------------------------------|-----|
| APPENDIX A | Pocket Barcode Reader Source Code | 80 |
| | i. Main Form | |
| | ii. Options Form | |
| | iii. ClientSocket Class | |
| APPENDIX B | Pocket Barcode Server Source Code | 94 |
| | i. Main Form | |
| | ii. ServerSocket Class | |
| APPENDIX C | Common Module Source Code | 105 |
| | i. Network Class | |
| | ii. Configuration Class | |

CHAPTER I

INTRODUCTION

The information age in today's world are characterized by rapid development and change. It moves faster than earlier eras and the pace continues to speed up. The continuous developments of computer technology in marketing, manufacturing, distribution, communications, transportation, healthcare and many sectors have played and continue to play a large part in accelerating change. For any business in this fast changing world, the importance of collecting and processing information on a timely basis is essential. In order to continue to be effective and able to respond to new customer requirements, every sector requires reliable information in real time or as close to it as possible. Due to this fact, barcode system is getting more and more important in providing solution for today's business needs in an efficient and economical way. In addition to this, with well over a billion mobile PDA handsets worldwide, wireless barcode system will be another key enabling to expand beyond the traditional limitation of fixed-line barcode system.

1.1 Project Background and Reviews

Barcode system normally operated by using a set of PC and wired infra-red scanner. This method of setup is the most popular and widely used in today businesses. Due to it advantages in accuracy and effectiveness of data tracking, their applications can be found in a vast range of organizations, including hypermarket and retail stores (point-of sale [POS] systems), libraries, hospitals, schools and factories (production and supply chain management). [11]

The traditional barcode system has successfully creeping into various industries and provides effective yet economy system for a lot of businesses. Although it has some portability limitation, it is still an un-removable system for today businesses.

1.1.1 Barcodes and its types

In terms of business use, barcodes have been promoted largely as a machine-readable “license plate,” where each label provides a unique serial number coded in black and white bars linking to a database entry containing detailed information. More recently, end users have sought to code more information; making the barcode a portable database rather than just a database key. One good example is the Data Matrix barcode, a two-dimensional (2D) matrix code as shown in Figure 1.1(e). A Data Matrix symbol typically stores between one and 500 characters. The symbol is also scalable, from a 1 millimeter square to a 14 inch square. Theoretically, a maximum of 500 million characters to the inch is possible, but the practical density will be limited by the resolution of the printing and reading technology used.

There are several varieties and standards for barcodes as shown in Figure 1.1. The symbol found on most retail products around the world is based on UPC/ EAN standards as shown in Figure 1.1(a), (b), (c) and (d). The Universal Product Code (UPC), developed by the Uniform Code Council (UCC), was the first barcode symbol widely adopted in the world. In 1973, the grocery industry formally established UPC as the standard bar code symbol for product marking in the United States. European interest in UPC led to the adoption of the European Article Numbering (EAN) code format in 1976 (EAN, 2003).

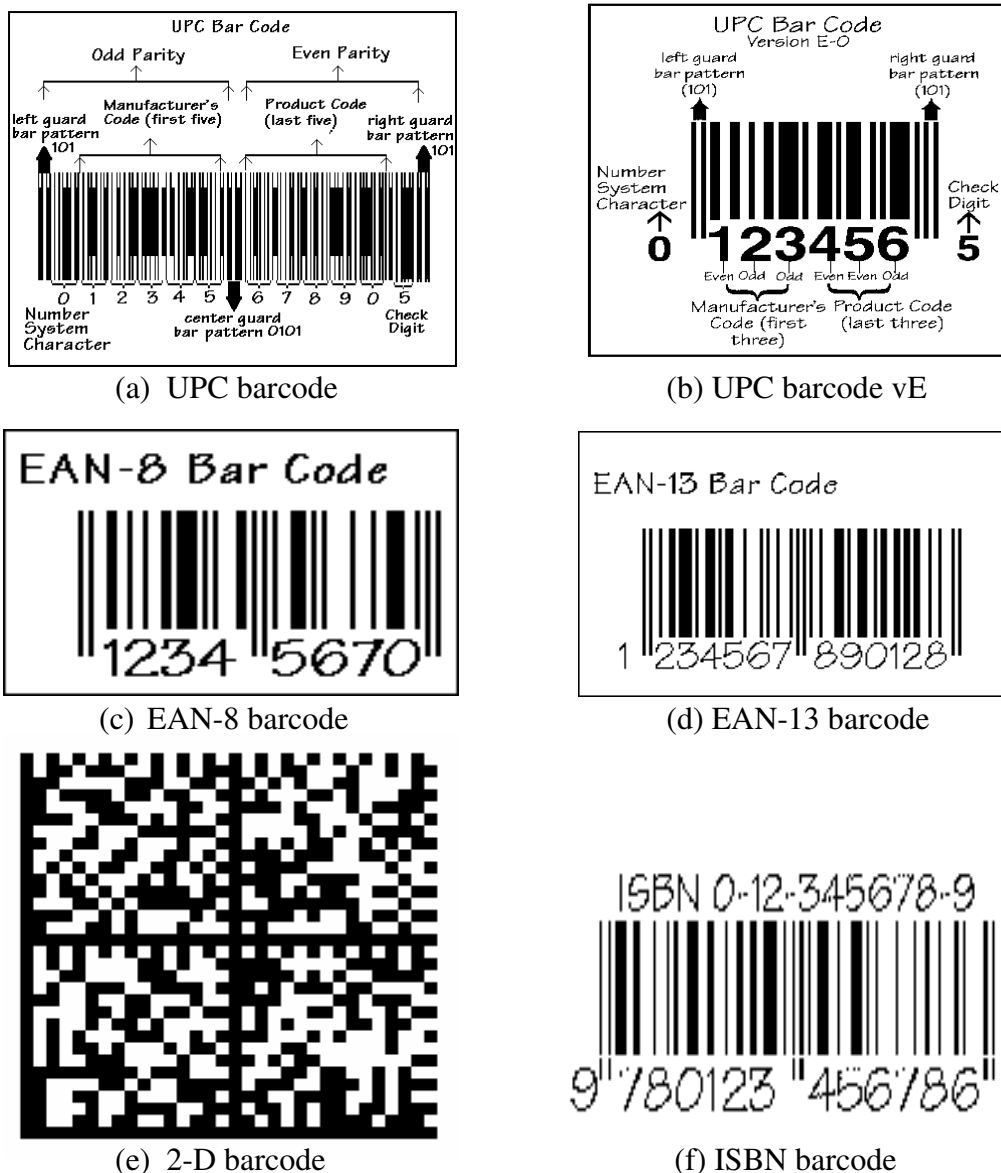


Figure 1.1 Sample of UPC, EAN, ISBN and 2D barcodes

Today, EAN International is a global non-profit organization that creates, develops, and manages jointly with the UCC open, global, multi-sector information standards, and the EAN/ UCC standards. All businesses must apply for membership in order to be assigned unique company identification number for use on all its products. There are now five versions of UPC and two versions of EAN. The Japanese Article Numbering (JAN) code has a single version identical to one of the EAN versions. UPC and EAN symbols are fixed in length can only encode numbers, and are continuous symbol using four element widths. The barcode used on books, for example, is generated based on the International Standard Book Number (ISBN) as shown in Figure 1.1(f). [11]

1.2 Problem Statement

Many of today working environment and industries require more and more worker to leave their fixed working space in order to conduct their work at changing location or while they are on the move. Due to this fact, mobile system is a must to enable worker to be able conduct their work effectively.

One pertinent area of recent barcode system development is in methods of enabling wireless barcode for personal transaction and information transfer. This has been an active research area including its technology, methodology and algorithm in performing and enabling those kinds of transactions. As of today, we can see that mobile barcode system has been in advance hospital patient's database tracking, mobile ticketing, e-wallet, real-time inventory tracking and etc. However, its application is still limited to only advance industries due to it cost, infrastructures and etc.

1.3 Objective and Scope of Project

The main objective of the project is to develop programs to enable wireless data transmission between PDA and PC for barcode system using WIFI. These programs will act as a medium to transfer picture captured by PDA and send it to PC for processing. Once processed, the PC will send the result of ASCII code back to the PDA for display. By having this model, it will save the computation time of PDA and at the same time speed up the decoding of barcode information. In addition, it will enable PDA client to get more up-to-date and accurate information from server.

At the end of this project, two programs will be developed. First program is the server program which will function as a server to receive multi-session connections from PDA clients and able to send ASCII code back to respective client that make request. Second program is the client program that will establish connection with server and send barcode image captured by PDA camera to server program for processing.

The scope of the project based on the objective above is; firstly, to identify and determine the required program specification and available interface between PDA and PC. Secondly is to determine the compatibility of operating system between PDA and PC, its programming language and available development kits. Thirdly is to develop and implement the networking model to enable data transmission between PDA and PC using WIFI with Microsoft Visual Studio 2005 C sharp programming integrated development environment (IDE). And finally, is to simulate and test the program using Microsoft Windows Mobile 5.0 Software Development Kit (SDK) emulator that runs Windows Mobile 5.0 with Virtual Machines Network Services installed for WIFI simulation.

1.4 Project Overview

The overall block diagram representing the proposed data transmission between PDA and PC model for barcode application is shown in Figure 1.2.

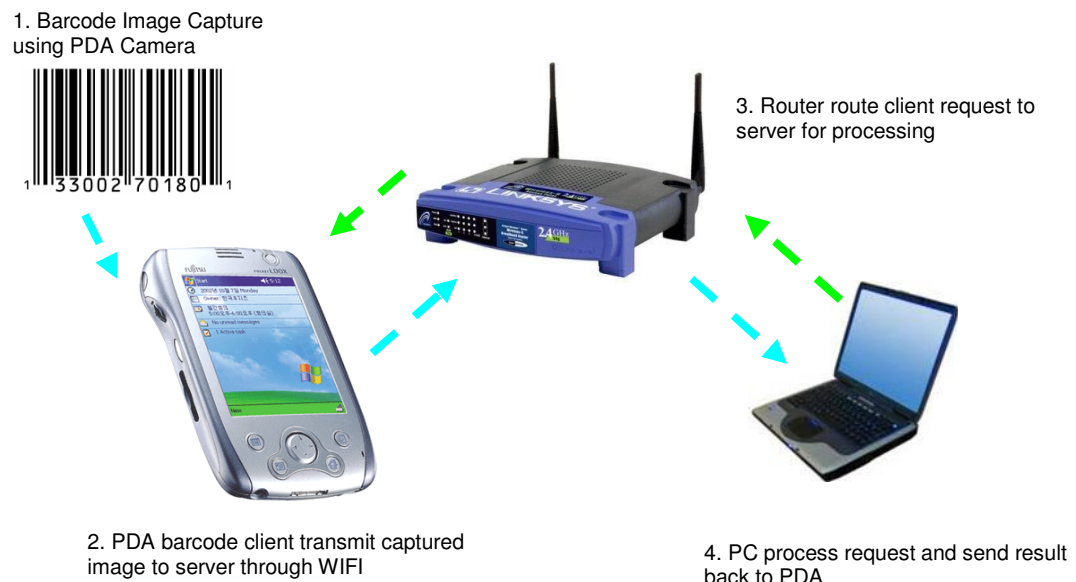


Figure 1.2 Block diagram of proposed PDA and PC data transmission model

A barcode image with minimum resolution of 640x480 captured by PDA camera will be stored as .jpeg format file in PDA. This image will then be

transmitted through WIFI using file transfer protocol (FTP) to server program. The role of wireless router is to route the request from client to server for processing. After the PC receives the image, the image will be processed and ASCII code of barcode info will be sent back to PDA through router.

The entire system uses three main components, PDA, PC and wireless router. This configuration will allow maximum of 256 clients (PDA) connected at one time per router. The speed of barcode decoding will vary based on the network bandwidth and server processing power.

1.5 Problems Challenges

Today, majority barcode system is still relying on PC and wired scanner. This system is not portable. Moreover, the existing mobile computing with wireless and built-in scanner is very expensive. It cost around USD 1,500 per unit [10]. This cost is too high and not economical for majority of today's business.

Due to above problem, the main improvement needed for barcode system is to provide an economical yet portable system for barcode scanning. The problem that needs to be solved is how to enable wireless data transmission for PDA and PC using WIFI on a regular PDA. However, compared to traditional barcode system, mobile devices enable barcode system has some disadvantages that need to be solved as below:

- ❖ Limited memory and CPU – Mobile devices are usually not equipped with the amount of memory and computational power in the CPU found in desktop computers.
- ❖ Small displays and limited input capabilities – for example, entering a URL on a Web enabled mobile phone is cumbersome and slower than typing with a keyboard.
- ❖ Low bandwidth – in comparison to wired networks, wireless networks have a lower bandwidth. This restricts the transfer of large data volumes.

- ❖ Connection stability – due to fading, lost radio coverage, or deficient capacity, wireless networks are often inaccessible for periods of time.

In order to solve limited memory and CPU processing power in mobile barcode system, the decoding function which consumes the most processing power will be shifted to the server. PDA will be used only to capture image, transmit image to server and display result.

For small displays and limited input capabilities problem, it can be solved by designing a simple yet comprehensive GUI with most frequent use button and features required by barcode system. By having this simple GUI, it can reduce the needs for user to type in input to operate the system. For low bandwidth problem, it can be solved or minimized by using the minimum resolution of image required to capture barcode.

Finally, for connection stability issue, it can be solved by integrating network reliability checking feature into program itself to ensure there is a stable and reliable connection before performing any transaction. In addition, packet checking algorithm will be integrated as well to detect if there is any corrupted packet during transmission through wireless network.

1.6 Summary

This chapter provides an overview of the barcode system, the challenges of mobile barcode system, and its simplified implementation in barcode decoding system. In the next chapter, the background and literature review of the key wireless technology used in mobile barcode system will be reviewed.