

DEVELOPMENT OF HARDWARE PART OF SMART ATTENDANCE SYSTEM

MOHD JUHAIDIL B MOHD KAMAR

**Laporan ini dikemukakan untuk memenuhi sebahagian daripada syarat
penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektronik
(Kejuruteraan Komputer) Dengan Kepujian**

**Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka**

May 2008

DEVELOPMENT OF HARDWARE PART OF SMART ATTENDANCE SYSTEM

MOHD JUHAIDIL B MOHD KAMAR

This report is submitted in partial fulfillment of the requirement for the award of Bachelor of Electronic Engineering (Computer Engineering) With Honours

**Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka**

May 2008



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

**BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II**

Tajuk Projek : Development of Hardware Part of Smart Attendance System
Sesi Pengajian : 2/ 2007/2008

Saya**MOHD JUHAIDIL BIN MOHD KAMAR**
(HURUF BESAR)

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan () :

SULIT*

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD*

(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

Alamat Tetap: NO. 519 BLOCK 14 JALAN 20/16,
SECTION 20, 40300 SHAH ALAM,
SELANGOR DARUL EHSAN.

Tarikh: 05/05/08


(COP DAN TANDATANGAN PENYELIA)

REDZUAN B ABDUL MANAP
Ketua Jabatan (Kej Telekomunikasi)
Fakulti Kej Elektronik dan Kej Komputer (FKEKK)
Universiti Teknikal Malaysia Melaka (UTeM)
Karung Berkunci 1200,
Ayer Keroh, 75450 Melaka

Tarikh: 8/5/08

DECLARATION


“I hereby declare that this report is result of my own effort except for works that have been cited clearly in the references.”

Signature 

Name : MOHD JUHAIBIL B MOHD KAMAR

Date : 05/05/06

“Saya akui bahawa saya telah membaca laporan ini dan pada pandangan saya laporan ini adalah memadai dari segi skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektronik (Kejuruteraan Komputer) Dengan Kepujian.”

Tandatangan: 

Nama Penyelia: **REDZUAN BIN ABDUL MANAP**

Ketua Jabatan (Kej Telekomunikasi)

Tarikh: **Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer (EKEKK)**

Universiti Teknikal Malaysia Melaka (UTeM)

Karung Berkunci 1200,
Ayer Keroh, 75450 Melaka

8/5/08

“I hereby declare that I have read this report and in my own opinion this report is sufficient in terms of the scope and quality for the award of Bachelor of Electronic Engineering (Computer Engineering) With Honours.”

Signature: 

Supervisor's Name: **REDZUAN B. ABDUL MANAP**
Ketua Jabatan (Kej Telekomunikasi)

Date: *8/5/08* **Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer (FKEKK)**
Universiti Teknikal Malaysia Melaka (UTeM)
Karung Berkunci 1200,
Ayer Keroh, 75450 Melaka

DEDICATION

To my beloved family daddy and mummy, my brothers, friends, staff at IRIS Corporation Berhad and especially not forgetting En. Redzuan B Abdul Manap for all of your support and courage

ACKNOWLEDGEMENT

So much that I have learnt through out the process of completion of these project and report. Here, I would like to express my gratitude to Allah S.W.T, the most gracious and most merciful, for giving me strength to finish these project and report.

First and foremost, I would like to express my sincere appreciation and gratitude to my final year project supervisor, Mr. Redzuan bin Abd. Manap and other lecturers Mr. Mazran bin Esro and Mr. Sani Irwan bin Md. Salim for their guidance, counsel, patient, and moral support: Their constant encouragement and enthusiasm with idea are great source of inspiration. I am deeply indebted to them whose help, stimulating suggestion and encouragement helped me completing this project. I extend my thanks to my PA, Mr Zulkarnain bin Zainuddin for his guidance and assistance to me from the beginning till the end of my study period at UTeM. Special thanks to my other supervisor from IRIS Corporation Berhad (Manager of QE Department) Pn. Azhanawati bt Abdul Wahab for giving guideline and keeping me on track during completion of this project. For other ICB- R&D engineers En Suhairol, David Mak and many more, thanks a lot. Last but not least, to my friends who have directly and indirectly assist and encourage me to accomplish this report, thank you very much.

ABSTRAK

Projek ini adalah berteraskan kesinambungan antara pembaca kad pintar dan pengimbas jap jari di dalam satu peralatan pintar. Peralatan pintar ini juga diperkemas lagi dengan penggunaan paparan 7 segmen yang digunakan untuk memaparkan maklumat ringkas kepada pelajar semasa menghadiri setiap sesi pembelajaran. Peralatan pintar ini akan ditempatkan di setiap bilik kuliah dan makmal di setiap universiti. Sistem ini secara permulaannya akan meminta pelajar untuk memasukkan kad pengenalan (MyKad) mereka kedalam peralatan pintar ini dan kemudian sistem ini akan mengkehendakki pelajar untuk meletakkan ibu jari tangan mereka pada pengesan jap jari yang disediakan pada peralatan pintar tersebut yang bertujuan untuk pengesanan dan merekod kehadiran mereka di dalam pengkalan data universiti. Sistem ini secara keseluruhannya dapat merekod dan mengawasi kehadiran setiap pelajar pada setiap sesi pembelajaran di universiti dan sekaligus dapat mengelakkan penipuan kehadiran oleh seseorang pelajar yang tidak bertanggungjawab.

ABSTRACT

The design of a smart device with a combined biometric fingerprint scanner and a smart card reader is proposed in this project. The device is proposed to first, access the information contained on the user by using the smart card reader and then verifies the identity of the smart card owner using the biometric fingerprint scanner. A possible application of his device is in monitoring the student attendance in lecture, tutorial and laboratory sessions. The device will be place at the door for every class and laboratory. This system needs the student to insert the MyKad and scan the thumbprint for every time the student entering and ending the classes and laboratories.

TABLE OF CONTENTS

| | Page |
|--|-------------|
| TITLE | i |
| DECLARATION | ii |
| DEDICATION | iii |
| ACKNOWLEDGEMENT | iv |
| ABSTRACT | v |
| TABLE OF CONTENTS | vi |
| LIST OF TABLE | vii |
| LIST OF FIGURE | viii |
| LIST OF ACRONYMS | ix |
| LIST OF APPENDIX | xix |
| CHAPTER 1: INTRODUCTION | |
| 1.1 PROJECT BACKGROUND | 1 |
| 1.2 PROBLEM STATEMENT | 3 |
| 1.3 OBJECTIVE OF THE PROJECT | 4 |
| CHAPTER 2: LITERATURE REVIEW | |
| 2.1 SMART CARD | 5 |
| 2.1.1 Evolution of the smart card industry and market trends | 5 |
| 2.1.2 Smart card growth in different industries | 7 |

| | | |
|------------|--|----|
| 2.2 | SMART CARD READER | |
| 2.2.1 | BCR100MS | 8 |
| 2.2.2 | Technical Data | 9 |
| 2.2.3 | Layout | 10 |
| 2.2.4 | How to use SmartBio BCR100MS | 13 |
| 2.2.5 | Features and Benefits of BCR100MS | 16 |
| 2.2.6 | Prototype of Smart card and Thumbprint Reader | 17 |
| 2.3 | BIOMETRIC (THUMBPRINT SCANNER) | |
| 2.3.1 | Theory | 18 |
| 2.3.2 | Why Biometric? | 18 |
| 2.3.3 | Finger-Scan | 19 |
| 2.3.4 | Components | 20 |
| 2.3.5 | How Finger Scanning Technology Works | 21 |
| 2.4 | IRIS SMARTCORE II (SC2) | |
| 2.4.1 | SC2 Hardware Specification | 25 |
| 2.4.2 | Biometric Fingerprint Scanner Specification | 26 |
| 2.4.3 | Physical Dimension | 27 |
| 2.5 | LIQUID CRYSTAL DISPLAY (LCD) CIRCUIT | |
| 2.5.1 | Theory | 28 |
| 2.5.2 | Text LCD Module | 30 |
| 2.5.3 | Installing LCD Module | 30 |
| 2.5.4 | Precaution for Handling LCD Module | 31 |
| 2.5.5 | Precaution for soldering to the LCD Module | 31 |
| 2.5.6 | Precaution for Operation | 32 |
| 2.5.7 | Operation of LCD Display (Hitachi HDD44780 module) | 32 |
| 2.5.7.1 | Registers | 32 |
| 2.5.7.2 | Busy Flag | 33 |
| 2.5.7.3 | Address Counter (AC) | 34 |
| 2.5.7.4 | Display Data RAM (DD RAM) | 34 |
| 2.5.7.5 | Character Generator ROM (CGROM) | 34 |
| 2.5.7.6 | Character Generator RAM (CGRAM) | 35 |
| 2.5.8 | LCD Schematic Circuit | 35 |
| 2.6 | MICROCONTROLLER | |
| 2.6.1 | Microcontroller option | 36 |
| 2.6.2 | PIC16F84A Microcontroller | 37 |
| 2.6.2.1 | Theory | 37 |
| 2.6.2.2 | History | 37 |
| 2.6.3 | PIC16F876A Microcontroller | 38 |

| | | |
|---|---|-----------|
| 2.7 | PIC PROGRAMMER | 39 |
| 2.8 | PC SERIAL PORT | 41 |
| | 2.8.1 Advantages of using serial data transfer rather than parallel | 41 |
| 2.9 | MAX 232 | 43 |
| CHAPTER 3: PROJECT METHODOLOGY | | |
| 3.1 | INTRODUCTION | 44 |
| 3.2 | FLOW CHART | 45 |
| 3.3 | BLOCK DIAGRAM | 47 |
| 3.4 | PROGRAMMING THE PIC | 48 |
| 3.5 | PREPARING THE PRINTED CIRCUIT BOARD (PCB) | 52 |
| CHAPTER 4: CIRCUIT DESIGN | | |
| 4.1 | SMART CARD READER CIRCUIT | 55 |
| 4.2 | LCD CIRCUIT DESIGN | 56 |
| CHAPTER 5: RESULT AND DISCUSSION | | 58 |
| CHAPTER 6: CONCLUSION | | 67 |
| REFERENCES | | 68 |
| APPENDICES | | 69 |

LIST OF TABLE**CHAPTER 2: LITERATURE REVIEW**

| | | |
|------------|--|----|
| Table 2.1: | Data Types and Associated Biometric Technologies | 19 |
| Table 2.2: | SC2 Hardware Specification | 25 |
| Table 2.3: | Biometric Fingerprint Scanner Specification | 26 |
| Table 2.4: | Physical Dimension | 27 |
| Table 2.5: | Microcontroller Comparisons | 36 |
| Table 2.6: | Comparison Between 87X Family | 38 |

LIST OF FIGURE

CHAPTER 2: LITERATURE REVIEW

| | | |
|--------------|--|----|
| Figure 2.1: | BCR 100MS | 8 |
| Figure 2.2: | Layout of BCR100MS | 10 |
| Figure 2.3: | Serial Cable | 11 |
| Figure 2.4: | BCR 100MS Characteristics | 12 |
| Figure 2.5: | Thumbprint match | 13 |
| Figure 2.6: | Thumbprint not match | 13 |
| Figure 2.7: | BCR100MS reader | 14 |
| Figure 2.8: | LED2 turn ORANGE | 14 |
| Figure 2.9: | LED2 turn GREEN | 15 |
| Figure 2.10: | LED2 turn RED | 15 |
| Figure 2.11: | Prototype of Smart card and thumbprint reader | 17 |
| Figure 2.12: | SC2 Module | 22 |
| Figure 2.13: | SC2 System | 23 |
| Figure 2.14: | Size of SC2 | 24 |
| Figure 2.15: | LCD Layer | 29 |
| Figure 2.16: | LCD vs. LED | 29 |
| Figure 2.17: | Register Selection | 33 |
| Figure 2.18: | DDRAM address for a character x 2 line display | 34 |
| Figure 2.19: | LCD Schematic | 35 |
| Figure 2.20: | PIC 16F876 pin diagram | 38 |
| Figure 2.21: | PIC Programmer Circuit Design | 39 |
| Figure 2.22: | GUI to burn program into PIC using WinPic800 | 40 |
| Figure 2.23: | PC serial port | 41 |
| Figure 2.24: | Max 232 configuration pins | 43 |

CHAPTER 3: PROJECT METHADODOLOGY

| | | |
|--------------|--|----|
| Figure 3.1: | Overall Project Methodology | 45 |
| Figure 3.2: | Workflow for complete operation of PIC | 46 |
| Figure 3.3: | Block Diagram for Microcontroller | 47 |
| Figure 3.4: | SourceBoost window | 48 |
| Figure 3.5: | Main Unit | 49 |
| Figure 3.6: | Program window | 49 |
| Figure 3.7: | Select PIC number | 50 |
| Figure 3.8: | Load File | 50 |
| Figure 3.9: | Select Program | 51 |
| Figure 3.10: | PCB Layout in ARES | 52 |
| Figure 3.11: | Transparent paper on PCB (left) and UV ray machine (right) | 53 |
| Figure 3.12: | Developing process | 53 |
| Figure 3.13: | Etching process | 54 |
| Figure 3.14: | Cutting the board. | 54 |

CHAPTER 4: CIRCUIT DESIGN

| | | |
|-------------|---------------------------------------|----|
| Figure 4.1: | Smart card and thumbprint reader used | 55 |
| Figure 4.2: | LCD schematic circuit | 56 |
| Figure 4.3: | LCD circuit simulation | 57 |

CHAPTER 5: RESULT AND DISCUSSION

| | | |
|-------------|---|----|
| Figure 5.1: | Prototype of Smart card and thumbprint reader | 58 |
| Figure 5.2: | LCD Schematic | 59 |
| Figure 5.3: | LCD controlled by PIC16F84A microcontroller | 61 |
| Figure 5.4: | LCD controlled by PIC16F876A microcontroller | 62 |
| Figure 5.5: | Front View | 64 |
| Figure 5.6: | Bottom View | 64 |
| Figure 5.7: | Top view | 65 |
| Figure 5.8: | Right side view | 65 |
| Figure 5.9: | Left side view | 65 |
| Figure 5.20 | System Flow Chart | 66 |

LIST OF ACRONYMS

| | |
|--------|--|
| CG RAM | Character Generator RAM |
| CMOS | Complementary Metal Oxide Semiconductor |
| DDRAM | Display Data RAM |
| DR | Data Register |
| EMV | Europe Master Visa |
| EEPROM | Electrical Erasable Programmable ROM |
| FKEKK | Fakulti Kejuruteraan Elektronik Kejuruteraan Komputer |
| GPIO | General Purpose Input Output |
| GSM | Global System Mobile |
| GUI | Graphical User Interface |
| IC-R&D | IRIS Corporation Berhad – Research and Development |
| IMM | Immigration Malaysia |
| IR | Instruction Register |
| JPN | Jabatan Pendaftaran Negara |
| JPJ | Jabatan Pengangkutan Jalan |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| MMC | Multimedia Card |
| MPU | Microprocessor Unit |
| MyKad | Malaysia Identity Card |
| OEM | Open End Module |

| | |
|-------|---------------------------------|
| OHP | Over Head Projector |
| PA | Penasihat Akademik |
| PC | Personal Computer |
| PCB | Printed Circuit Board |
| PCS | Personal Communication Services |
| PINs | Personal Identification Numbers |
| RS | Register Selector |
| RXD | Receive Data |
| SAM | Secure Access Module |
| SDRAM | Static Dynamic RAM |
| SMS | Short Messaging Service |
| TXD | Transmit Data |
| TTL | Transistor-Transistor Logic |
| USB | Universal Serial Base |
| UV | Ultra Violet |

LIST OF APPENDIX

| | |
|---|-----------|
| APPENDIX A (Datasheet PIC16F876A) | 70 |
| APPENDIX B (Datasheet LCD MODULE DEM 16216 SYH-PY) | 76 |
| APPENDIX C (Coding for LCD circuit) | 83 |
| APPENDIX D (Datasheet IRIS BCR100M READER) | 87 |

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

A smart device with a combined biometric fingerprint scanner and a smart card reader is to be designed in this project. A possible application of this device is in monitoring the student attendance in lecture, tutorial and laboratory sessions. The device is proposed to first, access the information contained on student smart card by using the smart card reader and then verifies the identity of the smart card owner using the biometric fingerprint scanner. The device is to be placed at the door for every class and laboratory. The student is to touch the smart card and scan the thumbprint every time when attending the lectures, tutorials and laboratories.

The smart reader is to be connected to the computer (database) via the Universal Serial Base (USB) cable and the Liquid Crystal Display (LCD) panel is to be connected to the computer via the serial cable and is controlled by the microcontroller (PIC16F876A). The timetable and student's name list for every class is stored in the database and the system marks the student attendance according to the timetable for each class.

The system requires less than 15 seconds to process the attendance for each student when attending lectures, tutorials and laboratories and mark their attendance into the database immediately. The computer (database) will be monitored and managed by the faculty officer for each faculty.

1.2 PROBLEM STATEMENT

Most of the university and college in Malaysia are still using the traditional systems on recording their student's attendance. For example the student only needs to write down their name on paper when attending the lecture, tutorial and laboratory. This method is not effective since the student can simply write his/her friends name who are absent from the class and the lecturer would not know. Some of the university and college in Malaysia currently use the smart card on recording their student's attendance but not with the student's thumbprint and this can also cause attendance cheating by students where the students can scan the card for their friends who are absent.

1.3 OBJECTIVE OF THE PROJECT

The main objective of this project is to avoid attendance cheating by the student for lectures, tutorials and laboratories by using an effective system called Smart Attendance System. The system will mainly be applied in academic center especially in campus and university. Biometric fingerprint scanner and a smart card reader are combined in the system. This type of system is already exists but it is not widely implemented and still has certain disadvantage.

CHAPTER 2

LITERATURE REVIEW

2.1 SMART CARD

2.1.1 Evolution of the smart card industry and market trends [2]

Due to vandalism and theft in the early 1980s, France's Public Telephone and Telegraph System began to move to coinless public telephone system that used "smart" cards to hold a prepurchased value. The smart cards about the size of a credit cards contained a "memory" chip that stored the value. The card could be inserted into a telephone card reader to activate the call and the cost is deducted

As the use of chip-based telephone cards grew worldwide, a new generation of smart cards began to emerge using an embedded microprocessor to control and safeguard the "exchange" of electronic currency. This new generation of smart card not only serves as a substitute for cash, it also provides added benefits: