TABLE OF CONTENTS

APPROVAL SHEET ..... **i**
INTELLECTUAL PROPERTY STATEMENT FORM ..... **ii**
ABSTRACT ..... **iv**
ABSTRAK ..... **v**
PREFACE ..... **vi**
TABLE OF CONTENTS ..... **vii**
TABLE OF FIGURES ..... **x**
LIST OF TABLES ..... **xiii**
LIST OF APPENDIX ..... **xv**
LIST OF SYMBOLS ..... **xvi**
CHAPTER I INTRODUCTION **1**
I.1 Research Background 1
I.2 Problem Statement 5
1.3 Research Objective 6
1.4 Research Limitation 6
1.5 Research Benefits 6
1.6 Writing Systematics 6
CHAPTER II LITERATURE REVIEW **8**
II.1 Jacquard Card 8
II.2 Punching Process 8
II.3 User Requirements Spesifications (URS) 9
II.3.1 Process Description 10
II.3.2 Control Philosophy 10
II.3.3 Electrical Diagram 15
II.4 Automation System 18
II.5 Automation Components 18
II.5.1 Sensor 20
II.5.2 Controller 25
II.5.3 Actuator 30
II.6 IEC 6113-3 Standard PLC Programming 34
II.7 Instrumentation 35

II.8 CX-Programmer v9.4 36
II.9 Excel Communication 37
II.10 HMI (Human Machine Interface) 38
II.11 Sequential Function Chart 39
II.12 Binary Number System 40
II.13 Previous Research 40
CHAPTER III RESEARCH METHOD 43
III.1 Conceptual Model 43
III.2 Problem Solving Systematics 44
III.2.1 Identification Phase 44
III.2.2 Initial Phase 45
III.2.3 Creative Phase 45
III.2.4 Simulation and Implementation Phase 46
III.2.5 Analysis Phase 46
III.2.6 Conclusion and Suggestion Phase 46
CHAPTER IV SYSTEM DESIGN 48
IV.1 Data Collection 48
IV.1.1 Identification of Existing System 48
IV.2 Existing Machine for Punching Process 51
IV.3 Proposed System Design 53
IV.3.1 System Design 53
IV.3.2 Process Description 54
IV.3.3 Control Philosophy 58
IV.3.4 Microsoft Excel 2007 Image Converter Excel Configuration 65
IV.3.5 PLC Configuration 68
IV.3.6 PLC Programming 69
IV.3.7 Input and Output Address Identification 70
IV.3.8 Program Transfer from PC to PLC 72
IV.3.9 Human Machine Interface (HMI) System Design 75
IV.4 Panel Box Set-Up 80
IV.5 Scenario Testing Program Software 82
IV.5.1 Scenario Testing Converter Image Program 82
IV.5.2 Scenario Testing PLC Program 83
IV.5.3 Scenario HMI Program 84

IV.6 Scenario Testing Model Design 86
CHAPTER V SYSTEM DESIGN ANALYSIS 87
V.1 Analysis of System Design Result 87
V.1.1 Analysis of Process Description 87
V.1.2 Analysis of Control Philosophy 88
V.1.3 Analysis of Electrical Diagram 95
V.1.4 Analysis of PLC Devices 95
V.1.5 Analysis of PLC Program 97
V.2 Analysis of Image Converter to Excel 109
V.3 Analysis of PLC Program Result 110
V.4 Analysis of HMI Program 111
V.5 Analysis of Panel Box 117
V.6 Analysis of System Advantages 118
CHAPTER VI CONCLUSION AND SUGGESTION 119
VI.1 Conclusion.....119
VI.2 Suggestion 119
REFERENCES.....120