

TABLE OF CONTENTS

| | |
|--|------|
| ABSTRACT | i |
| <i>ABSTRAK</i> | ii |
| PREFACE | iii |
| TABLE OF CONTENTS | v |
| LIST OF FIGURES | viii |
| LIST OF TABLES | xi |
| LIST OF APPENDIX | xii |
| TERMINOLOGY | xiv |
| CHAPTER I INTRODUCTION | 1 |
| I.1 Research Background | 1 |
| I.2 Problem Definition | 4 |
| I.3 Research Objective | 4 |
| I.4 Research Boundaries | 4 |
| I.5 Benefit of Research | 4 |
| I.6 Writing Systematics | 4 |
| CHAPTER II LITERATURE REVIEW | 6 |
| II.1 Industrial Revolution 4.0 | 6 |
| II.2 Green Manufacturing | 7 |
| II.3 Automation System | 11 |
| II.3.1 Elemets of Automation System | 12 |
| II.3.2 Controller | 13 |
| II.3.3 Actuator | 13 |
| II.4 CX-Programmer | 14 |
| II.5 Punching Process | 14 |
| II.6 Electricity motor | 14 |

| | | |
|---|---|----|
| II.7 | Previous research..... | 15 |
| CHAPTER III RESEARCH METHODOLOGY | | 17 |
| III.1 | Conceptual Model..... | 17 |
| III.2 | Problem Solving Systematic..... | 18 |
| III.2.1 | Identification Phase | 18 |
| III.2.2 | Initiation Phase | 18 |
| III.2.3 | Creative Phase | 19 |
| III.2.4 | Implementation Phase | 19 |
| III.2.5 | Analysis Phase..... | 19 |
| III.2.6 | Conclusion and Suggestion Phase | 19 |
| CHAPTER IV COLLECTING AND DATA PROCESSING | | 21 |
| IV.1 | Identification of Existing System | 21 |
| IV.1.1 | Overall Process Flow..... | 21 |
| IV.1.2 | Existing Condition..... | 24 |
| IV.2 | Design of Green Manufacturing System | 24 |
| IV.2.1 | Color Identification | 24 |
| IV.2.2 | Improvement Object..... | 25 |
| IV.2.3 | Green Implementation..... | 26 |
| IV.3 | Automation System Design | 26 |
| IV.3.1 | Machine Description | 26 |
| IV.3.2 | Sytem Requirement | 28 |
| IV.3.3 | Excel Configuration | 32 |
| IV.3.4 | PLC Configuration | 34 |
| IV.3.5 | PLC Program Script | 34 |
| IV.3.6 | Input and Output Address Identification | 35 |
| IV.3.7 | Program Transfer from PC to PLC..... | 37 |

| | | |
|---|---|----|
| IV.3.8 | Scenario Testing PLC Program | 38 |
| IV.3.9 | HMI Design | 39 |
| IV.4 | Calculation of Energy Consumption..... | 41 |
| CHAPTER V SYSTEM ANALYSIS | | 43 |
| V.1 | Analysis Of Automation System Result..... | 43 |
| V.1.1 | Analysis of Excel Configuration | 43 |
| V.1.2 | Analysis PLC Configuration | 43 |
| V.1.3 | Analysis Program on Main Process..... | 43 |
| V.1.4 | Analysis of PLC Program Scenario Testing result..... | 47 |
| V.1.5 | Analysis of Human Machine Interface (HMI) | 48 |
| V.1.6 | Analysis of HMI Scenario Testing result | 50 |
| V.2 | Analysis Consumption Energy toward flexibility | 50 |
| V.3 | Analysis qualitative automation impact to flexibility | 53 |
| V.4 | Analysis of automation impact to green manufacturing..... | 54 |
| CHAPTER VI CONCLUSION AND SUGGESTION..... | | 55 |
| VI.1 | Conclusion | 55 |
| VI.2 | Suggestion..... | 55 |
| REFERENCES..... | | 56 |