

## TABLE OF CONTENTS

VALIDITY SHEET .....	i
ORIGINALITY STATEMENT SHEET .....	ii
DOCUMENT REVISION TIMELINE .....	iii
FOREWORD .....	iv
ACKNOWLEDGMENTS .....	v
TABLE OF CONTENTS.....	vi
LIST OF IMAGES.....	x
TABLE .....	xi
LIST OF ABBREVIATIONS.....	xii
ABSTRACT.....	xiii
ABSTRAK.....	xiv
CHAPTER 1 NEEDS ANALYSIS .....	1
1.1    Background of the problem .....	1
1.2    Supporting Information.....	3
1.3    Constraints .....	4
1.3.1    Economic Aspect.....	4
1.3.2    Usability Aspect .....	4
1.3.3    Sustainability Aspect .....	4
1.3.4    Operational Aspect .....	4
1.4    Needs to Be Met.....	4
1.5    Purpose.....	5
CHAPTER 2 SPECIFICATIONS AND VERIFICATION .....	6
2.1    Product Specifications .....	6
2.1.1    Specification #1 .....	6
2.1.2    Specification #2 .....	6

2.1.3	Specification #3 .....	7
2.1.4	Specification #4 .....	7
2.1.5	Specification #5 .....	7
2.1.6	Specification #6 .....	7
2.2	Verification .....	8
2.2.1	Specification Verification 1 .....	8
2.2.2	Specification verification 2 .....	9
2.2.3	Specification verification 3 .....	9
2.2.4	Specification verification 4 .....	9
2.2.5	Specification verification 5 .....	10
2.2.6	Specification verification 6 .....	10
CHAPTER 3 DESIGN SOLUTION .....		11
3.1	Solution Concept .....	11
3.1.1	Function Diagram .....	11
3.1.2	Proposed System Solution Alternatives .....	12
3.2	System Selection .....	14
3.2.1	System Selection Criteria .....	14
3.2.2	Decision Matrix .....	15
3.2.3	Selected systems to be developed .....	16
3.3	System Design Plan .....	16
3.3.1	Block Diagram Level 0 .....	16
3.3.2	Slot status, battery SoC, battery SoH, and battery cycle flowchart .....	16
3.3.3	Battery temperature flowchart .....	18
3.3.4	Cabin temperature flowchart .....	18
3.3.5	Application Flowcharts .....	19
3.3.6	Website Flowchart .....	19
3.3.7	Website Prototype .....	22

3.4 Component Selection.....	24
3.4.1 Module Selection.....	24
3.4.2 IoT Platform Selection.....	25
3.5 Work Schedule.....	26
CHAPTER 4 SOLUTION IMPLEMENTATION .....	27
4.1 System Implementation .....	27
4.1.1 Subsystem 1: Tapping Data BMS .....	27
4.1.2 Sub-system 2: Cabin Temperature Sensor Reading .....	29
4.1.3 Sub-System 3: Post Data to Firebase.....	30
4.1.4 Sub-System 4: GET Data .....	40
4.2 Analysis of System Implementation Work.....	43
4.3 System Integration Final Results .....	44
CHAPTER 5 SYSTEM TESTING .....	46
5.1 System Testing.....	46
5.1.1 Specifications Testing 1: Battery Normality .....	46
5.1.2 Specification Testing 2: Battery SoC, battery voltage, and battery current	48
5.1.3 Specifications Testing 3: Information of battery availability .....	50
5.1.4 Specifications Testing 4: Battery temperature and cabin temperature .....	52
5.1.5 Specifications Testing 5: System making cost .....	57
5.1.6 Specifications Testing 6: Work in real-time.....	57
5.2 Conclusion and Advice .....	66
5.2.1 Conclusion .....	66
5.2.2 Suggestion .....	67
BIBLIOGRAPHY.....	68
CD-1 APPENDIX.....	71
CD-2 APPENDIX.....	79
CD-3 APPENDIX.....	80

CD-4 APPENDIX.....	82
CD-5 APPENDIX.....	105