

TABLE OF CONTENTS

TABLE OF CONTENTS.....	vi
TABLE OF FIGURES.....	xi
LIST OF TABLE.....	xiv
LIST OF ABBREVIATIONS.....	xvi
ABSTRAK.....	xvii
ABSTRACT.....	xviii
CHAPTER 1 NEEDS ANALYSIS.....	1
1.1 The Background of the Problem.....	1
1.2 Supporting Information.....	2
1.3 Constraint.....	4
1.3.1 Economic Aspect.....	5
1.3.2 Manufacturability Aspect.....	5
1.4 Requirements to be Fulfilled.....	6
1.5 Goal.....	6
CHAPTER 2 SPECIFICATION AND VERIFICATION.....	8
2.1 Product Spesification.....	8
2.1.1 Specification #1 Communication Range.....	8
2.1.2 Specification #2 Communication Speed.....	9
2.1.3 Specification #3 Power Supply.....	9
2.1.4 Specification #4 User Interface.....	10
2.1.5 Specification #5 System Monitoring.....	11
2.2 Verification.....	12
2.2.1 Verification #1 Communication Range.....	13
2.2.2 Verification #2 Communication Speed.....	13
2.2.3 Verification #3 Power Supply.....	13
2.2.4 Verification #4 User Interface.....	13

2.2.5	Verification #5 System Monitoring	14
CHAPTER 3	SOLUTION DESIGN.....	15
3.1	Solution Concept.....	15
3.1.1	Function Diagram	15
3.1.2	Proposed Alternative System Solution	18
3.2	System Selection.....	23
3.2.1	System Selection Criteria	23
3.2.2	Decision Matrix	24
3.2.3	Selected System to be Developed.....	25
3.3	System Design Plan	26
3.3.1	Level 0 Block Diagram.....	26
3.3.2	Level 1 Block Diagram.....	27
3.3.3	Level 2 Block Diagram.....	28
3.3.4	Flowchart	30
3.3.5	Componen Selection.....	35
3.3.6	Work Schedule	42
CHAPTER 4	IMPLEMENTATION OF THE SOLUTION.....	47
4.1	System Implementation	47
4.1.1	Node Sensor Subsystem	47
4.1.2	Gateway Subsystem.....	96
4.1.3	Monitoring Subsystem.....	117
4.2	System Implementation Work Result	140
4.3	Hasil Akhir Integrasi Sistem	143
CHAPTER 5	SYSTEM TESTING	146
5.1	System Testing.....	146
5.1.1.	Testing Specification 1 : ”Design a weather monitoring tool that incorporates a remote communication module for accurate wireless data transmission”	146

5.1.2.	Testing Specification 2 : “ Ensure that the product is capable of transmitting data at enabling quick and real-time information exchange. ”	148
5.1.3.	Testing Specification 3 : “ Equipping weather monitoring nodes with renewable energy. ”	150
5.1.4.	Testing Specification 4 : ” Provide the product with an intuitive and userfriendly user interface. ”	152
5.1.5.	Testing Specification 5 : “ Cyber-Physical System (CPS) designed for weather monitoring system that can collect, store, and analyze data accurately an accessibly. ”	154
5.2.	Kesimpulan dan Saran	156
5.2.1.	Kesimpulan	156
5.2.2.	Saran	157
DAFTAR PUSTAKA	159
LAMPIRAN CD-1	163
A.	Mission Statement.....	163
B.	Interpret Raw Data	164
C.	Five Guidelines in Writing Need Statement	165
D.	Features Survey.....	166
E.	Curriculum Vitae	167
a.	Curriculum Vitae 1	167
b.	Curriculum Vitae 2	169
c.	Curriculum Vitae 3	170
LAMPIRAN CD-2	173
A.	Automatic Weather Station Price.....	173
B.	Tools Parts of Automatic Weather Station	173
LAMPIRAN CD-3	174
a.	Details of Selected Sensor Node Components	174
b.	Details of Selected Gateway Components.....	175

LAMPIRAN CD-4.....	176
a. Power Supply Node Sensor	176
b. Solar Panel Node Sensor	177
❖ Pengujian Tanpa Beban.....	177
❖ Pengujian Dengan Beban	177
c. Temperature and Humidity.....	178
❖ Source Code Temperature and Humidity.....	179
❖ Testing and calibration data	179
d. Air Pressure Testing and Calibration Data	182
❖ Source Code Air Pressure	183
❖ Testing and Calibration data	183
e. Light Intensity Testing and Calibration Data	185
❖ Source Code Light Intensity.....	186
❖ Testing and Calibration data	186
f. Light Intensity UV Testing and Calibration Data	187
❖ Source Code Light Intensity UV.....	188
❖ Testing and Calibration data	188
g. Rainfall Testing and Calibration Data	189
❖ Source Code Rainfall	190
❖ Testing and Calibration data	190
h. Wind Speed Testing and Calibration Data	191
❖ Source Code Wind Speed.....	192
❖ Testing and Calibration data	192
• Low	192
• Medium.....	193
• High.....	193
i. Wind Direction Testing and Calibration Data.....	194

❖	Source Code Wind Speed.....	194
❖	Testing and Calibration data	195
j.	Agriculture Node Testing and Calibration Data.....	197
❖	Source Code Agriculture Node	197
❖	Testing and Calibration data	200
k.	LoRa Sender	202
❖	Source Code Lora Sender.....	202
l.	Node Sensor.....	203
❖	Source Code Node Sensor.....	203
m.	Gateway Source Code.....	206
n.	Database.....	211
o.	Server.....	214
p.	Capturing Data with Wireshark.....	215
LAMPIRAN CD-5.....		217
➤	Specification Arduino ATMEGA 2560	217
➤	Specification TTGO LoRa32 Lilygo.....	218
➤	Specification BMP280	218
➤	Specification GYML8511	218
➤	Specification SHT21	219
➤	Specification BH1750	219
➤	Specification Rainfall	219
➤	Specification Wind Speed	219
➤	Specification Wind Vane Direction	220
➤	Specifiacation Soil Moisture + RS485	220
➤	Specification Gateway.....	221