TABLE OF CONTENTS

	ACKNOWLEDGEMENT	*I*
	Table of CONTENTS	*II*
	LIST OF FIGURES	*V*
	LIST OF TABLES	*VII*
	LIST OF Symbols and abbreviations	*VIII*
	ABSTRACT	*X*
CHAPTER 1	***INTRODUCTION***	1
1.1	Research Motivation	2
1.2	Thesis Definition	4
1.3	Main Contribution	6
1.4	Thesis Outline	8
CHAPTER 2	***RFID Systems***	10
2.1	RFID Systems	11
2.2	Overview of RFID systems	13
2.3	Frequencies Range	14
2.4	RFID Standards	16
2.4.1	Electronic product code (EPC) standards deal with	17
2.4.1.1	Auto-ID center proposed options	18
2.4.1.2	EPC global Network function	20
2.4.1.3	EPC Code Structure	20
2.4.2	The international organization for standardization (ISO) standards deal with	22
2.4.2.1	ISO Standards for RFID	23
2.5	RFID Privacy	24
2.6	RFID Security	25
2.6.1	Protecting data stored on tag	25
2.6.2	Protecting the integrity of the tag	27
2.6.3	Protecting data related to the serial number on the tag	27
2.7	RFID technology cost	27
2.7.1	Reader and tags	29
2.7.2	Middleware and servers	30
2.7.3	Servers	31
2.7.4	Enterprise applications	31

2.8	Comparison of Barcode VS RFID system characteristic	32
2.9	Advantage and disadvantages of RFID system	33
2.10	RFID Application	35
2.11	RFID authentication protocols classification	39
CHAPTER 3	***Counter Attack Methodology for Preventing Attack on Ultra-lightweight protocols***	44
3.1	RFID Protocols Classification	45
3.2	SASI Protocol	47
3.2.1	SASI protocol Stages	48
3.3	Attacking on RFID protocols	50
3.4	The security analysis and performance evaluation of SASI protocol Security analysis	51
3.4.1	Security Analysis of SASI protocol	52
3.4.2	Performance evaluation of SASI protocol	55
3.5	Simple comparison of ultra-lightweight authentication protocols	57
3.6	Attacks on SASI protocol	58
3.6.1	The first attack	58
3.6.2	The Second attack	60
3.7	Ultra-lightweight anti-de-synchronization RFID identification proposed methodology	61
CHAPTER 4	***Counter attack methodology for preventing vulnerabilities or attacks on SASI***	66
4.1	SASI implementation description	67
4.2	First Attack implementation description	68
4.3	Second Attack Implementation description	70
4.4	The proposed approach	72
4.4.1	Scenario 1.	73
4.4.1.1	Preventing the first and second attacks using the first scenario.	73
4.4.2	Scenario 2.	76
4.4.3	Scenario 3.	79
4.4.3.1	Preventing the first and second attacks using the third scenario.	80
4.4.4	Scenario 4.	83
4.4.5	Scenario 5.	84
4.4.6	Scenario 6.	85
4.4.7	Scenario 7.	86
4.5	Communication cost	88
4.6	Storage Cost	90

4.7 Performance comparison of ultra-lightweight authentication protocols 91

CHAPTER 5 Conclusions AND Future Work *94*
5.1 Conclusions 95
5.2 Contributions 97
5.3 Future work 98

LIST OF REFERENCES 99

Publications 104

Appendix: A Code Classes Diagrams

A.1 Reader Classes Diagrams 106
A.2 Tag Classes Diagrams 111