

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	viii
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
	LIST OF ABBREVIATIONS	xvi
1	INTRODUCTION	1
	1.1 Overview	1
	1.2 Background of the Problem	2
	1.3 Problem Statement	4
	1.4 Project Aim	5
	1.5 Project Objectives	5
	1.6 Project Scope	5
	1.7 Summary	6
2	LITERATURE REVIEW	7
	2.1 Introduction	7
	2.2 Image File Formats	8
	2.2.1 Image Parameters	9
	2.2.2 Most Common Used Image Format	12

2.2.3	Red Green Blue (RGB) Images	14
2.3	Steganography	16
2.3.1	MSE and PSNR Formulas	17
2.3.2	Different Forms of Steganography	18
2.3.3	Steganographic Methods	19
2.3.4	Least Significant Bit (LSB) Insertion	
	Steganography	22
2.3.4.1	LSB in BMP	23
2.3.4.2	LSB in PNG Image	26
2.3.4.3	Steganography in GIF image	27
2.4	Steganalysis	27
2.4.1	Steganalysis Methods	29
2.4.2	Steganalysis Against LSB	30
2.5	Choosing the Best Location in the Cover Image to Hide Information	32
2.5.1	Coding Framework	36
2.6	Intelligent Data Embedding Method for LSB Steganography	37
2.6.1	Neural Networks Learning System	39
2.7	Summary	40
3	RESEARCH METHODOLOGY	41
3.1	Introduction	41
3.2	Requirements Specifications	42
3.3	Prototype Architectural Design	42
3.4	Prototype Development	44
3.5	Testing the Results	44
4	PROTOTYPE DESIGN	45
4.1	Introduction	45
4.2	Design Challenges	46
4.3	The Prototype Architecture	48

4.3.1	First Security Layer (AES Encryption)	49
4.3.2	Second Security Layer (Adaptive Segmentation)	50
4.3.3	Third Security Layer (Main Cases and Sub Cases)	51
4.3.4	Fourth Security Layer (Neural network)	57
4.3.5	Extraction and Decryption Layer	60
4.4	Operational Phases	63
4.5	Summary	63
5	PROTOTYPE IMPLEMENTATION	64
5.1	Introduction	64
5.2	Implementation Phases	64
5.3	Prototype Code Structure and UML Diagrams	68
5.4	Summary	83
6	TESTING THE RESULTS AND CONCLUSION	84
6.1	Introduction	84
6.2	The Benchmark	84
6.3	Prototype Usage Limitations	87
6.4	Testing Approaches And Methods	87
6.4.1	Program Performance	88
6.4.2	Results Listing and Analyzing	89
6.4.2.1	Experiment to Hide Very Small Amount of Information (459bytes)	91
6.4.2.2	Experiment to Hide (9 K.B) of Information	93
6.4.2.3	Embedding Experiment Using This Prototype and Maximum Embedding Ability of S-Tools	95
6.4.2.4	Embedding Experiment Using Maximum Embedding Ability of Both This Prototype and S-Tools	98
6.5	Meeting The Objectives	101

6.6 Summary And Conclusion 102

REFERENCES 103

LIST OF TABLES

TABLE NO.	TITLE	PAGE
4.1	Narrowing down sub cases selection into 3 groups of sub cases	53
4.2	Choosing the particular suitable sub case for the current pixel	53
6.1	Results of the experiment to hide very small amount of information (459 bytes)	91
6.2	Results of the experiment to hide (9 K.B) of information using this prototype and S-Tools	94
6.3	Results of embedding experiment using this prototype and maximum embedding ability of S-Tools	96
6.4	Results of embedding experiment using maximum embedding	99

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	CT Image Example	10
2.2	Framework for Secret Key Passive Warden Steganography	17
2.3	Least significant bit Steganography insertion	22
2.4	Steganography process to embed secret message in an image	23
2.5	The embedding method and its detection	35
2.6	A Multi-Layered Perceptron (n-p-n) Neural Networks	39
2.7	Neural based Steganography training system architecture	40
3.1	Workflow sequence chart	41
4.1	The overall flowchart of how the proposed prototype works	45
4.2	Prototype layers	49
4.3	First security layer (AES encryption) flowchart	50
4.4	Second security layer (adaptive segmentation)	51
4.5	Third security layer (main cases and sub cases) which is the first Steganography layer	56
4.6	The Neural Network layer	58
4.7	The extraction and Decryption Layer	60
4.8	Main cases and sub cases layer operation during the extraction process	61

4.9	Neural Network operation during extraction and decryption layer	62
5.1	Main components (functions) of the prototype code	70
5.2	Text file handling diagram	71
5.3	Finding the Cover Image Properties	72
5.4	Segmentation and Data Hiding	74
5.5	The Neural Network	75
5.6	Computations of Visual and Statistical Measures	77
5.7	Information Extraction handling	78
5.8	Information Extraction	80
5.9	The User Interface for the prototype (the embedding and measures)	82
5.10	User Interface for the prototype (Information Extraction)	82
6.1	Pop up message informing the user about using the neural network	88
6.2	Pop up message informing the user to select another text file	89
6.3	Visual and statistical measures comparison for Stego Images from this prototype and Stego images from S-Tools in the experiment to hide very small amount of information (459 bytes)	92
6.4	Visual and statistical measures comparison for Stego images from this prototype and Stego images from S-Tools in the experiment to hide (9 K.B) of information	95
6.5	Visual and statistical measures comparison for Stego images from this prototype and maximum capacity Stego images from S-Tools for the embedding experiment using this prototype and maximum embedding ability of S-Tools	97

6.6	Visual and statistical measures comparison for Stego images from maximum embedding Capacity of both this prototype and S-Tools	100
-----	--	-----

LIST OF ABBREVIATIONS

AES	-	Advanced Encryption Standard
ASE	-	Adaptive Smoothing Error
BMP	-	Bitmap
BP	-	Back Propagation
DLL	-	Dynamic Linked Library
DOS	-	Disc Operating System
FAT	-	File Allocation Table
GIF	-	Graphic Interchange Format
GUI	-	Graphical User Interface
HVS	-	Human Visual System
JPEG	-	Photographic Experts Group
KB	-	Kilo Byte
LSB	-	Least Significant Bit
MB	-	Mega Byte
MC and SC		Main Cases and Sub Cases
MSE	-	Mean Squared Error
PDF	-	Probability Density Function
PNG	-	Portable Network Graphics
PRNG	-	Pseudo Random Number Generator
PSNR	-	Peak Signal-to-Noise Ratio
QIM	-	Quantization Index Modulation
RA	-	Repeat-Accumulate
RGB	-	Red Green Blue
TIFF	-	Tagged Image File Format
UML	-	Unified Modeling Language
VB	-	Visual Basic