

## LIST OF FIGURES

2.1 Digital Image. (a) Binary Image, (b) Grayscale Image, (c) Color Image . . . . .	8
2.2 Classification of a general data security system . . . . .	12
2.3 Block Diagram of Quantum Image Hiding . . . . .	14
2.4 Bloch Sphere . . . . .	15
2.5 Circuit and Matrix of Top Rotation-X Gate (2 qubits) . . . . .	19
2.6 Circuit and Matrix of Bottom Rotation-X Gate (2 qubits) . . . . .	19
2.7 Circuit and Matrix of Top Rotation-X Gate (3 qubits) . . . . .	20
2.8 Circuit and Matrix of Bottom Rotation-X Gate (3 qubits) . . . . .	21
2.9 2×2 FRQI Image . . . . .	23
2.10 FRQI Image . . . . .	23
3.1 Flowchart of proposed scheme . . . . .	29
3.2 Block Diagram of proposed scheme . . . . .	30
3.3 Segmentation into blocks . . . . .	30
3.4 Quantum Circuit for Watermark Embedding . . . . .	32
3.5 Embedding Process . . . . .	32
3.6 Extraction Process . . . . .	33
3.7 The First Step of The Quantum Circuit for Embedding . . . . .	33
3.8 The Second Step of The Quantum Circuit for Embedding . . . . .	34
3.9 The Third Step of The Quantum Circuit for Embedding . . . . .	35
3.10 The Fourth Step of The Quantum Circuit for Embedding . . . . .	36
3.11 The Fifth Step of The Quantum Circuit for Embedding . . . . .	37
3.12 The Sixth Step of The Quantum Circuit for Embedding . . . . .	38
3.13 The Seventh Step of The Quantum Circuit for Embedding . . . . .	39
3.14 The Eighth Step of The Quantum Circuit for Embedding . . . . .	40
3.15 The Ninth Step of The Quantum Circuit for Embedding . . . . .	41
3.16 Quantum Channel Attack on Pauli Gates for 3 qubit with $p_X = p_Y = p_Z = \frac{1}{3}$ . . . . .	45
3.17 Quantum Channel Attack on Pauli Gates for 3 qubit with $p_X = 1, p_Y = p_Z = 0$ . . . . .	45
3.18 Quantum Channel Attack on Pauli Gates for 3 qubit with $p_X = p_Z = 0, p_Y = 1$ . . . . .	46

3.19	Quantum Channel Attack on Pauli Gates for 3 qubit with $p_X = p_Y = 0, p_Z = 1$ . . . . .	46
4.1	Host Images . . . . .	48
4.2	Watermark Image . . . . .	48
4.3	PSNR-H for All Host Images . . . . .	50
4.4	PSNR-W for All Host Images . . . . .	52
4.5	BER for All Host Images . . . . .	53
4.6	PSNR-W at Different Noise Probability Levels with Attack $p_x = p_y = p_z = \frac{1}{3}$ . . . . .	56
4.7	PSNR-W at Different Noise Probability Levels with Attack $p_x = 1, p_y = 0, p_z = 0$ . . . . .	56
4.8	PSNR-W at Different Noise Probability Levels with Attack $p_x = 0, p_y = 1, p_z = 0$ . . . . .	57
4.9	PSNR-W at Different Noise Probability Levels with Attack $p_x = 0, p_y = 0, p_z = 1$ . . . . .	58