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# CHAOTIC PICTURE ENCRYPTION BY APPLYING QUANTUM CHAOTIC SYSTEM: A REVIEW PAPER

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***Abstract***

*How to protect the classified information is an essential topic in commercial or military application. Attributed to quantum chaotic system that can be characterized by sensitive dependence to initial conditions/parameters, a new colour image encryption scheme based on quantum chaotic system is proposed in this paper. Firstly, a new substitution scheme is accomplished by scrambling only the Y (Luminance) part of the low frequency sub band based on complete auto morphism in integer wavelet transformation. Then, with the help of the adopted quantum chaotic map, two diffusion modules are achieved by combining the features of horizontally and vertically adjacent pixels. Finally, with the aid of the quantum chaotic system, substitution/confusion is achieved by generating an intermediate chaotic main stream picture. Based on several experimental experiments and review, several safety and performance evaluations were thoroughly provided. Sufficient protection and good efficiency are brilliant features of the proposed colour image encryption solution. Much of the findings are in favor of the proposed scheme by contrast.*

***Keywords:*** *Cryptosystem, Encryption, Image, Multimedia Data, System, Data protection, Safety.*

## I. INTRODUCTION

In recent years, the cryptosystem, attributed to chaotic processes, has received a great deal of interest, in particular for its potential role in information security. Chaotic systems have strong features such as initial conditions/parameter sensitivity, ergodicity, property mixing. Moreover,

microprocessors and personal computers make it easy to incorporate chaotic systems [1]. In general, chaotic cryptosystems generally have high speed and low cost, which makes them better candidates for multimedia data encryption than many traditional cyphers [2].

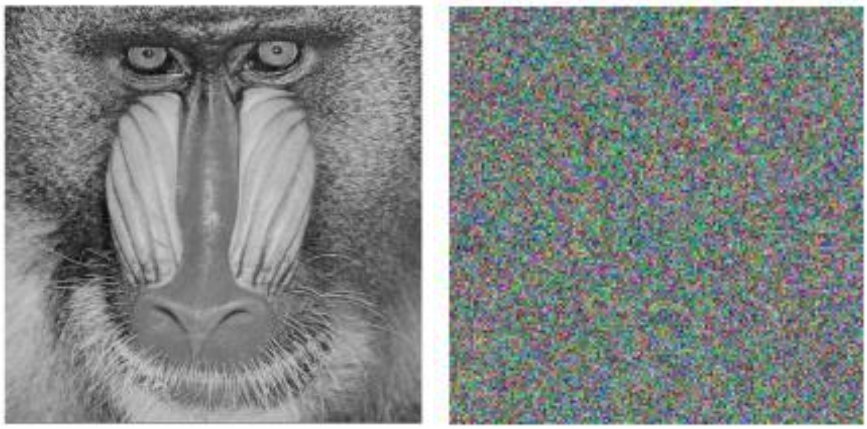

Fig.1: Illustrates the Real Images and Encrypted Images.

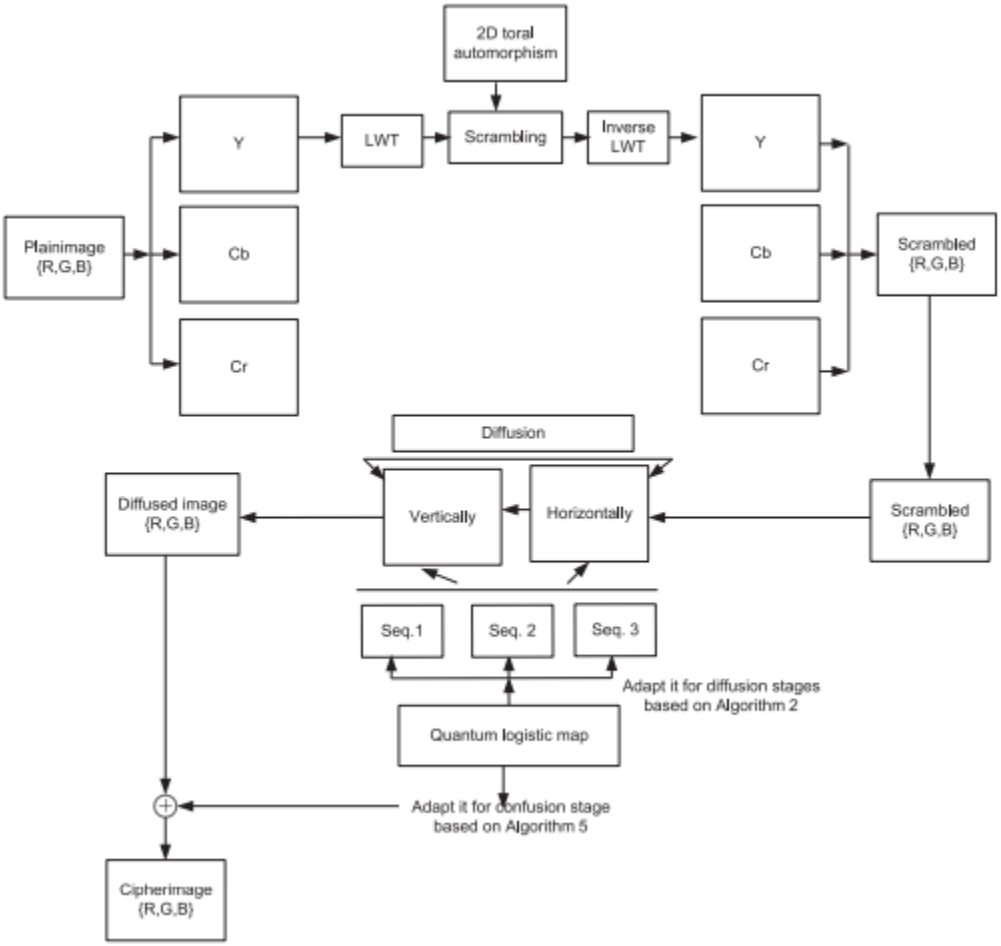


Fig. 2: Illustrates the flow chart for the proposed encryption approach [3]

$$E(x) = \frac{1}{N}\sum_{i=1}^{N} x_i$$

$$D(x) = \frac{1}{N}\sum_{i=1}^{N} (x_i - E(x))^2$$

$$cov\,(x,y) = \frac{1}{N}\sum_{i=1}^{N} (x_i - E(x))\;(y_i - E(y))$$

$$r_{xy} = \frac{cov\,(x,y)}{\sqrt{D(x)}\sqrt{D(y)}}$$

$$\sqrt{D(x)} \neq 0, \sqrt{D(y)} \neq 0$$

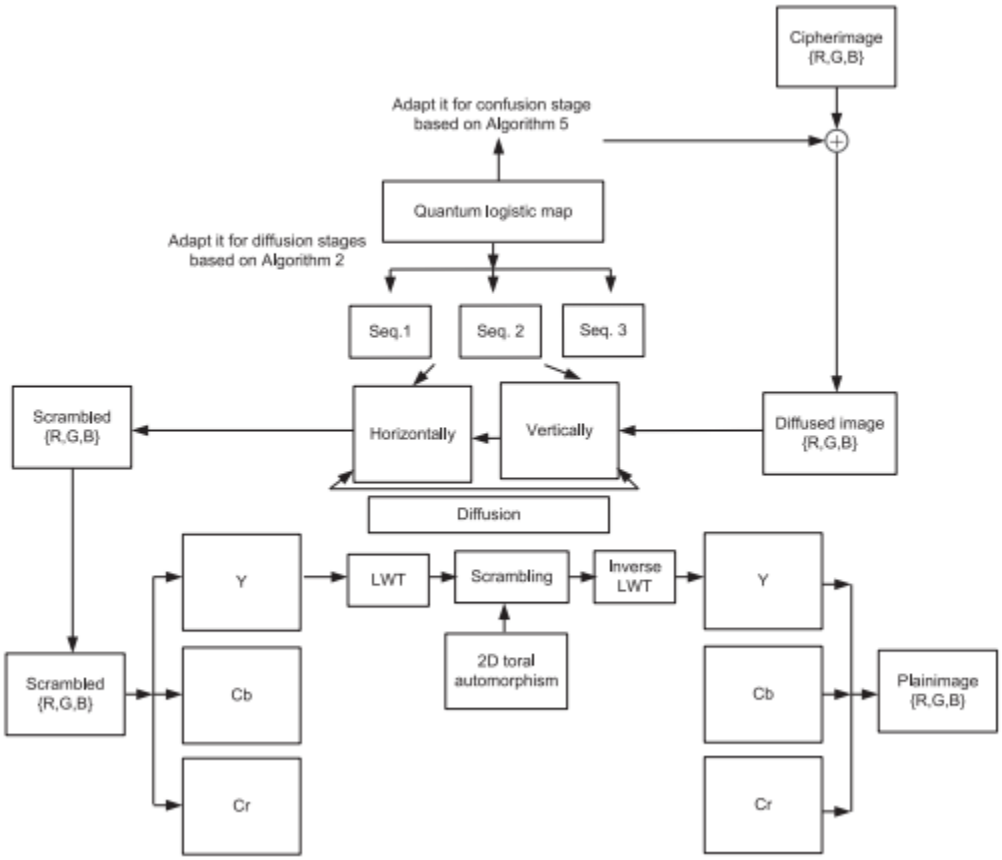


Fig. 3: Illustrates the flow chart for the proposed decryption approach [4]

Attributed to chaotic systems, cryptosystem has gained much attention over recent years particularly, for its potential role in information security. Chaotic systems have good features such as sensitivity to initial conditions/parameters, ergodicity, mixing property [5].

$$NPCR = \frac{1}{M \times N} \sum_{i=1}^{M} \sum_{j=1}^{N} D(i,j) \times 100\ \%$$

$$UACI = \left[ \sum_{i=1}^{M} \sum_{j=1}^{N} \frac{|C1(i,j) - C2(i,j)|}{255} \right] \times \frac{100\%}{M \times N}$$

$$D(y) = \frac{1}{K}\sum_{i=1}^{K}(y_i - E(y))^2$$

## II. LITERATURE REVIEW

An analysis was performed by Guan et al on the Chaos-based image encryption algorithm. A new image encryption scheme is introduced in this letter, in which shuffling the locations and adjusting the grey values of the image pixels are combined to confuse the cipher-image and plain-image relationships. Firstly, the Arnold cat map is used to shuffle the spatial-domain locations of the image pixels. The Chen's chaotic system's discrete output signal is then preprocessed to be sufficient for the grayscale image encryption, and the shuffled image is encrypted pixel by pixel by the preprocessed signal. The experimental results show that the key space is wide enough to withstand the attack of brute force and the distribution of the encrypted image's grey values has a random-like conduct [6].

## III. DISCUSSION AND CONCLUSION

A new colour image encryption scheme based on a quantum chaotic method is suggested in this paper. Firstly, a new substitution scheme is accomplished by scrambling only the Y (Luminance) part of the low frequency sub band based on complete auto morphism in integer wavelet transformation. Then, with the help of the adopted quantum chaotic map, two diffusion modules are achieved by combining the features of horizontally and vertically adjacent pixels. Finally, with the aid of the quantum chaotic system, substitution/confusion is achieved by generating an intermediate chaotic main stream picture. Based on several studies, we have performed several security and efficiency assessments. The results show that the approach proposed retains strong encryption efficiency and outperforms most of the literature's suggested schemes.

## IV. REFERENCES

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