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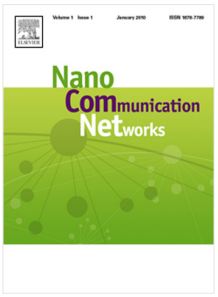

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Design of Image Steganographic Architecture Using Quantum-Dot Cellular Automata for Secure Nanocommunication Networks

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Abstract:

The objective of this article is to introduce an architecture that performs image steganography. The architecture is built on quantum dot cellular automata (QCA) technology. The reason behind increasing use of QCA device is that it provides low device density with small amount of power dissipated. To encode message inside an image, Least Significant Bit (LSB) based encoder/decoFder steganography circuit has been proposed. To design this encoder/decoder circuit, a new QCA XOR gate has been designed. The proposed QCA XOR gate has low device density and less cell count compare to other existing circuits. The proposed circuit also requires less amount of power. The Mean Square Error (MSE), Peak Signal to Noise Ratio (PSNR), and Structural Similarity Index Method (SSIM) are used to measure the embedded information is in the acceptable range or not. The design accuracy is confirmed through simulation results and power analysis performed.

Keywords:

QCA, Steganography, Image, LSB, Nanocommunication, Power dissipation.

1. Introduction

Quantum Dot Cellular Automata (QCA) is a developing field of nanotechnology [1-5]. A great progress has already been recorded in the field of Very Large Scale Integration (VLSI). But in the near future there will be a decline in its progress due to some of its inherent problems. The problem rises due to interconnections and high power dissipation. Since within a very small area, numerous devices are stuffed together, which give rise to a great amount of heat when switching from one cycle to another cycle. This heat cannot be reduced as well as sustained by the chip and thereby causes damage to it. Since the size of the chip is reducing day by day whereas the wire resistance and capacitance are not reduced in comparison to the size and thereby generating the problem. QCA [6-10] can be considered as a substitute to VLSI technology. It provides a great speed, great integrity and less power consumption. Parallel processing is also possible using QCA [11-14]. The QCA technology has many implementations and one of its implementation is steganography. This article proposes a circuit which is designed using QCA technology to perform color image steganography. Steganography is a data hiding process through which any piece of data can be hidden inside another piece of data. The proposed circuit performs image steganography in which an image will be used as a cover media to hide any string message. Least Significant Bit (LSB) based approach is used to perform image steganography. The idea is hiding message within the least significant bit, thus the change in original image is minimum. The proposed circuit has low device density than any other existing circuit and has low power dissipation.