Chapter 4
Hardware Implementation of a Visual Image Watermarking Scheme Using Qubit/Quantum Computation Through Reversible Methodology

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ABSTRACT

In this chapter, hardware implementation of an LSB replacement-based digital image watermarking algorithm is introduced. The proposed scheme is developed in spatial domain. In this watermarking process, data or watermark is implanted into the cover image pixels through an adaptive last significant bit (LSB) replacement technique. The real-time execution of the watermarking logic is developed here using reversible logic. Utilization of reversible logic reduces the power dissipation by means of no information loss. The lesser power dissipation enables a faster operation as well as holds up Moore's law. The experimental results confirm that the proposed scheme offers high imperceptibility with a justified robustness.

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INTRODUCTION

New age digital data communication offers easy access over data processing. So, Data security is essential to put off illegitimate copying or forgery attempts over transmission channel. The increasing consumer number proportionally causes a huge data augmentation which is easily performed in digital domain. But the possessor demands a copyright protection to their belongings multimedia data so that the information remains tenable. Thus the copyright protection has become a challenging research point in this rapidly developing multimedia communication domain. A good number of secured data transmission methods are invented in terms of cryptography, steganography, digital watermarking etc. during last few decades.

In cryptography the message itself converted into a distinct and unreadable form and transmitted through a secret channel. Cryptographic systems are unable to provide enough protection and reliability for data authentication. Moreover the cryptographic techniques are not reversible in nature which causes data loss. Steganography is a point to point data transmitting process where the message is made imperceptible in a cover object. The message may have nothing to do with the cover as the cover is required only to serve the purpose of concealment. On the other hand digital watermarking is the process to embed a unique code (may be in form of text or image or any multimedia object), said watermark into a cover object to make an assertion on it. Being offering a one-to-many communication without any type of secret channel or encryption, watermarking is preferred for copyright protection.

A good number of digital watermarking algorithms have been developed to reach the maximum rate of efficiency in terms of three exigent qualities of – robustness, imperceptibility and payload capacity. The software logic level development for insertion process can be performed in spatial or frequency domain. Though the frequency domain provides robustness, spatial domain is chosen for effective real time hardware implementation.

Field programmable gate array (FPGA) is one of the most intended tools for hardware execution but the more alarming issue of modern VLSI industry is power dissipation. The exponential growth of transistors within an IC causes generation of heat which results into information loss. Therefore supporting the pace of Moore's law has become gradually more complicated over modern systems. The solution was received from the new age quantum computation. The development of quantum hardware also defines the hardware software co-simulation. This quantum computation can be performed through Reversible circuits of which logic operations theoretically ensure zero percent computational sate data loss and thus the inputs could be recovered from the outputs. This property can be fully utilized in designing the hardware architecture of an effective watermarking embedding and extracting model with minimum power dissipation.

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