Chapter 2
A Glimpse of Hardware Design Approaches

ABSTRACT

In this chapter, the authors have described that in order to design the vein enhancement and feature extraction algorithm, different modules such as DSP, embedded processor, hardware accelerator, and FPGA are implemented. Further, it has also been revealed in this chapter that the performance of the vein algorithm implemented on the Nios-II and DSP processor is not considered fast though the DSP processor is designed for signal processing applications. The FPGA is an acceptable choice for researchers due to low-cost factors. The FPGA is implemented for the hardware design of the vein algorithm. However, the performance result was not fast. Furthermore, to cater to the need for better performance, innovative hardware design architecture is the need of the time. It is observed that if there are considerable calculations in the algorithm, the optimization of the algorithm with the parallel processing capabilities of hardware will be a good choice as it can mitigate the error of the calculations.

INTRODUCTION

A biometric system is mainly a pattern-recognition system. The prime task of the biometric system is to recognize a person based on feature vectors. These feature vectors are derived by researchers Prabhakar S. et al. (2003) from specific physiological or behavioral characteristics that the person possesses.

DOI: 10.4018/978-1-7998-4537-9.ch002

Further, (Wayman, 1998) proposed a vein pattern detection and proved that it fully comply with this definition and it also provides many biometric features of paramount importance such as (1) Uniqueness and permanence of the pattern (2)Non-contact detection procedure (3)Almost impossible to forge or copy (4) The biometric parameter is hidden from general view.

Perhaps, the vein pattern is considerably complicated to allow sufficient criteria for effectively detecting various subjects, even in the case of identical twins. Indeed, the vein detection process consists of a device that can easily capture a snapshot of the subject's veins. Almost any part of the body could be analyzed in order to extract an image of the vascular pattern, but the hand and the fingers are preferred.

Hardware design is of paramount importance in the realm of vein image enhancement as well as in feature extraction. This chapter will present different pertinent aspects related to vein image enhancement and feature extraction. Moreover, a deep insight pertaining to different hardware design issues of this domainis given.

Sub-section literature review renders abrief literature review of algorithms associated with vein enhancement and feature extraction.The bi-cubic interpolation is briefly discussed in next sub-section. Finally, the chapter is concluded.

LITERATURE REVIEW

In (Khalil et al., 2010), a finger vein biometric feature extraction and matching system is proposed. This system implemented an embedded system on the Altera Field Programmable Gate Arrays (FPGA) and it uses Nios-II Linux Real-Time Operating System (RTOS), as shown in Figure1. Different modules of thisembedded system architecture are as follows:

- Image Acquisition Module
- Image Pre-processing Module
- Feature Extraction Module
- Matching Module