Chapter 6
Performance Evaluation of Hardware Designs, Thinning, and Segmentation Algorithms in M-Health Environments

ABSTRACT

In this chapter, the authors have described the experimental analysis steps required for converting original veins images into thinned veins images by applying resample, segmentation, filtering, and thinning algorithms in the cloud IoT-based m-health environments. It is a little bit difficult to make a distinction between the vein pattern and the surroundings particularly in the cases of unclear and thin veins images. However, after applying the resample, segmentation, median filters, and thinning algorithms in the cloud IoT-based m-health environment, the superior quality veins image patterns of a single line are obtained.

PERFORMANCE EVALUATION OF HARDWARE DESIGNS IN m-HEALTH ENVIRONMENT

After completing the hardware design of veins' image enhancement and feature extraction algorithms, the performance of the developed system must be evaluated in cloud and IoT based m-health environment using standard tools and technologies. The algorithms and methodologies are simulated for

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sample veins images in the m-health environment using MATLAB 11. The results obtained from MATLAB are used as a reference for evaluating the performance of hardware design (Saini & Rana, 2014; Lingyu & Leedham, 2006). The hardware designs are simulated using a hardware design language simulator called ModelSim-Altera for the sample images of veins in the m-health environment. The results obtained from the ModelSim-Altera software tool are compared using MATLAB 11.0 functions for evaluating the performance of hardware designs of different algorithms. In order to accomplish the tasks of result analysis following two steps is used (Hashimoto, 2006; Hashimoto, 2011; Xie, 2012):

Step I: Independently evaluate the hardware design performance for re-sampling, segmentation, median filter, and thinning techniques.

Step II: Evaluate the hardware design performance for the *Top Vein,* which is the integration of all the techniques in the m-health environment.

The Performance Analysis of Resample, Segmentation, Median Filter and Thinning Techniques

In this section, the performance of hardware designs for re-sampling, segmentation, median filter and thinning are evaluated independently in the cloud IoT-based m-health environment. Figure 1 shows the interaction between inputs and outputs of different components of palm-dorsa based veins image enhancement and feature extraction technique while evaluating the performance of re-sampling, segmentation, median filter, and thinning hardware designs in the cloud IoT-based m-health environment (Khmag, 2014; Saad, 2012; Chen, 2009; Liu et al., 2016).

The ensuing veins images obtained from hardware design are compared with the resultant veins images obtained from MATLAB for comparison in the cloud IoT-based m-health environment. Here, each pixel of the veins images is compared to analyze the exactness of results obtained from hardware design. The hardware designs of the Re-sampling, Segmentation, Median Filter, and Thinning are determined and are compared with the average execution time obtained for MATLAB implementation. The experiments were conducted by the researchers using MATLAB and the ModelSim-Altera on Windows 7 / Windows 10 with Intel i5 / i7-4710HQ (2.5GHz) and 8 GB RAM. The performances of described hardware designs are analyzed (Mukherjee et al., 2015; Lin et al., 2010; Lin et al., 2008; Gabarda et al., 2007).