DEVELOPMENT OF AN FPGA BASED SMART DIAGNOSTIC SYSTEM FOR SPIROMETRIC DATA PROCESSING APPLICATIONS

Shubhajit Roy Chowdhury1, Dipankar Chakrabarti2, Hiranmay Saha3,
1,3IC Design and Fabrication Centre,
Department of Electronics and Telecommunication Engineering,
Jadavpur University, Kolkata-700032.
2Om HealthNet Telemedicine Private Limited, Kolkata-700055
Email: 1shubhajit@juicentre.res.in, 2dc_ohnet@gmail.com, 3hsaha@juiccentre.res.in

Abstract- The paper describes the development of an FPGA based fuzzy processing system for pulmonary spirometry applications predicting the approaching obstructive or restrictive pulmonary disorder of the patient before criticality actually occurs. The system employs a smart agent that accepts the Peak Expiratory Flow Rate (PEFR), Forced Expiratory Volume in 1 second (FEV1) and Forced Vital Capacity (FVC) data of patients. In order to speed up the computation process, hybrid parallel data processing architectures with dynamic scheduling mechanism have been employed leading to a speed up of approximately 12 times. The processor implemented on the FPGA can perform fuzzy inferencing at a speed of approximately 5.0 MFLIPS. The whole system is realized on Altera Cyclone EP1K6Q240C8 FPGA chip requiring 5,865 logic blocks. The system has been designed to be inexpensive, portable and user friendly for occupational health care applications in developing countries. Using the system, approaching pulmonary disorder of patients has been predicted with an accuracy of 95.83%.

Index Terms: Spirometry, fuzzy processor, hybrid parallel data processing architectures, smart agent