PREFACE

The thesis describes the system model to analyze human blood tissue matrix. It is well known that the human blood is a multivariate system consisting of approximately 118 major constituents. Glucose is one such constituent, which provides instant energy for cell metabolism, and the imbalance in glucose, leads to various health problems. The thesis emphasizes the need to develop non-invasive blood glucose measuring technique and describe other techniques presently being used to quantify glucose. The working principles of different radiation based techniques of glucometers are described in full detail and the reasons for choosing the development of IR radiation based methods for the research work. The main contribution in this work is simulation of multivariate system model and which can be used to quantify the blood glucose.

The model thus developed has the ability to quantify other constituents of blood which are detrimental for the human health. The simulation spectra for the human blood were generated using Lorentz oscillator technique to compute the calibration and prediction error in the multivariate model. The present study takes into account 7 major variants influencing the human health and two physical parameters (temperature and skin complexion) while designing the system model.

The digital signal processing system required for the processing of spectral data for multivariate analysis was designed using NIOS II soft core processor using text based paradigm and was implemented on the programmable devices. The thesis also describes the use of graphics based design on FPGA for high speed processing. The thesis also gives the detailed design of the instrumentation involved for the implementation of the above developed system model. It also describes the methods for calibration of various subsystems required for the development of the whole instrument and has given good scope for further research work of similar multivariate systems.

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