

ABSTRACT

This study focuses on the design and implementation of a non-invasive glucose concentration measurement system in solution using a 60 GHz wave-based Frequency Modulated Continuous Wave (FMCW) BGT60r13C radar. This method utilizes changes in the refractive index of electromagnetic waves to estimate glucose concentrations in the range of 50–1000 mg/dL. The issues addressed include the limitations of conventional invasive methods, which are impractical for continuous monitoring, and previous studies that generally tested narrow concentration ranges. Key challenges include maintaining measurement accuracy at a fixed sensor distance, minimizing environmental interference, and optimizing signal processing to distinguish concentration variations. Data was collected at a distance of 3 cm over 1 minute, then processed through debiasing, windowing, zero-padding, and Fourier transformation. The features used are the partial energy of five frequency sub-bands, which serve as input for a 1-D Convolutional Neural Network (CNN) model. This model achieved 82% validation accuracy, indicating that the developed FMCW radar approach can reliably measure glucose concentration in solutions without invasive methods.

Keywords: FMCW Radar, Non-Invasive, Glucose, FFT, 1D-CNN