ABSTRACT

Respiratory rate is an important vital sign that is often overlooked in clinical practice, yet it has a crucial role as an early indicator of physiological condition deterioration. Respiratory rate is measured in units of breaths per minute (BrPM). This research aims to develop a non-contact respiratory rate measurement system using optical flow algorithms (Lucas-Kanade) on RGB camera images. The system is designed to track visual feature movements in the chin-to-abdomen area through Shi-Tomasi feature detection.The processing stages include adaptive pre-processing with grayscale image conversion, Gaussian filtering, Region of Interest (ROI) selection, feature detection on body surface edges, optical flow processing, and signal analysis using Empirical Mode Decomposition (EMD). Testing was conducted on 35 subjects under pre- and post-physical activity conditions involving running. Results show that the system achieved a Mean Absolute Error (MAE) of 3,12 BrPM in pre-activity conditions with a systematic bias of 0,89 BrPM. However, perfomance decreased significantly in post-activity conditions with MAE of 6,81 BrPM and systematic bias of 6,04 BrPM. The accuracy decline is caused by the system's limitations in managing lighting intensity variation and rapid, large body movements . The system demonstrated clinically acceptable accuracy levels in pre-activity conditions with 82,86% of subjects having errors below 5 BrPM, but requires further development to overcome dynamic post-activity conditions with higher error rates where only 62,86% of subjects achieved errors below 5 BrPM.

Keywords: *Systematic Bias, Brightness Constancy, RGB Camera, Respiratory Rate, Lucas-Kanade, Optical Flow, Non-Contact Measurement, Shi Tomasi, Small Motion.*