
Non-Contact Heart Rate Monitoring using Impulse-Radio Ultra-Wideband (IR-UWB) Radar Technology

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Vital signs, heart rate and respiratory rate, are considered as the key parameters when assessing the medical conditions of a person. The continuous monitoring of these parameters of critically ill patients, elderly and infants in intensive care units or at homes is very important to identify anomalies. Electrocardiogram (ECG), Photoplethysmogram (PPG) and Phonocardiogram (PCG) are the conventional technologies that have been using for this purpose in the medical field. The requirements such as permanent wiring and skin contact of these technologies limit the mobility, comfort and independency of patients. Furthermore, this can also cause other serious problems such as spreading infections and false fatigue. Therefore, there is a high demand for non-contact vital sign monitoring technologies that can provide medically acceptable accuracy levels. With the advances in electrical engineering discipline, novel engineering solutions are proposed to fulfill this requirement. In this work, Impulse-Radio Ultra-Wideband (IR-UWB) radar technology is considered with the advanced signal processing techniques. In particular, we developed an advanced signal processing algorithm to extract information from IR-UWB radar signals to estimate heart rate with desired accuracy level. The proposed algorithm is initially tested using a publicly available radar data set. It was observed that the estimated heart rate of the radar based contactless approach is 72.11 bpm whereas the ECG recorded value of the data set is 72.96 bpm. This result confirms that the proposed signal processing algorithm can estimate the heart rate accurately by extracting the relevant information in the given radar data set. The next step of this work is to test the proposed algorithm in real time. We will use IR-UWB radar sensor platform from Novelda for this purpose as it shows a very good signal penetration power. Due to the good penetration power, IR-UWB radar sensor technology can detect heart motions from outside.

Keywords: Electrocardiogram (ECG), Impulse-radio ultra-wideband (IR-UWB) radar, Non-contact heart rate monitoring, Vital signs