Chapter 19
Smart Technology for Non Invasive Biomedical Sensors to Measure Physiological Parameters

K Rajasekaran
Karunya University, India

Anitha Mary Xavier
Karunya University, India

R Jegan
Karunya University, India

ABSTRACT

Communication and Information technologies are transforming our lifestyles, social interactions, and workplaces. One of the promising applications of the information and communication technology is healthcare and wellness management. Advancement in electronic health care and mobile have made doctors and patients to involve the modern healthcare system by extending the capabilities of physiological monitoring devices. Various biomedical sensors are being used to measure the physiological parameters like pulse rate, blood glucose level, blood pressure etc., Among various bio-sensor, Researchers from different field of science are particularly and increasingly interested in Photoplethysmography (PPG) signals. This chapter addresses the importance of bio sensors and its principle, significance of remote monitoring of PPG signal using Radio Frequency (RF) and design challenges in RF connectivity. Also this chapter presents a reliable low power wireless transmission mechanism of biomedical signals which works on narrow band RF frequencies.

1. IMPORTANCE OF BIO SIGNALS

Bio signal can be defined as a description of a physiological phenomenon. Commonly used bio signals are Electroencephalogram (EEG), Electrocardiogram (ECG) Electromyogram (EMG) Mechanomyogram

DOI: 10.4018/978-1-5225-0920-2.ch019

(MMG) Electrooculography (EOG), Galvanic skin response (GSR), Magneto encephalogram (MEG). Among these bio signals, ECG and PPG signals are widely used.

A *photoplethysmogram (PPG)* is an optically obtained using plethysmogram, a volumetric measurement of an organ. A PPG is often obtained by using a pulse oximeter which illuminates the skin and measures changes in light absorption. PPG technique allows us to study heart beat rate thereby increasing the reliability of clinical measurements. It is also used to evaluate the vascular blood flow resistance which is found to be an important physiological parameter for vascular diagnostics. PPG pulse wave analysis helps to study diabetes and arthritis which is unique for each individual and helps to get unique identification as biometric identification. It also helps to study large artery damage & an abnormality in the cardiovascular disease which is one of the common causes of high mortality rate. PPG analysis emphasizes the importance of early evaluation of the diseases (Tamura et.al., 2014).

Electrocardiogram (ECG) signals are used for diagnosis of heart diseases. Figure 1 shows the waveform of ECG signal. The QRS waveforms which are used to indicate electrical activity of heart over a period of time are called Electrocardiography (Kumar 2010).

The electrical activity of heart is found using electrodes placed in patient's body. Normally in a 12 lead ECG, ten electrodes are placed on the patient's limbs and on the surface of the chest (shown in Figure 2) and the magnitude of electrical activity from twelve leads are recorded over 10 seconds (Lee and Chung 2009, Engel 2010). This non-invasive procedure of obtaining magnitude and direction of electrical activity is called cardiac cycle.

Figure 1. ECG waveform