Purpose

This application note describes how an ECG (ElectroCardioGram) can be measured using a SmartPhone with a case containing Plessey Semiconductors' Electric Potential Integrated Circuit (EPIC) sensor.

Introduction

EPIC is an electrometer capable of sensing ECG signals through insulated sensors in contact with the skin. The sensors are dry-contact, so that the gels or other contact-enhancing substances normally associated with wet-electrode ECG pads are not necessary. As well as offering exciting possibilities for simplified ECG monitoring by medical professionals, this technology also makes it possible for individuals to view and collect their own detailed ECG signals on a portable device such as a SmartPhone.

SmartPhone Application

The ECG trace ideally requires two electrical signals from parts of the body on opposite sides of the heart. By mounting two sensor electrodes on the rear of a SmartPhone case, these signals are easily obtained from fingers on both hands just by holding the phone, as shown in figure 1.
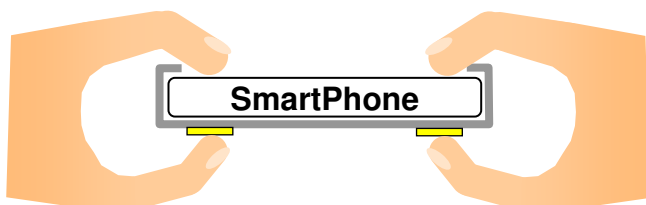

Figure 1: Diagrammatic representation showing user holding smartphone and touching one sensor with each hand

To produce the ECG trace shown in figure 2 the *ECG sensor in a SmartPhone* application requires

1. A case - into which is built the EPIC sensors and some electronics to amplify, filter and digitise the signal and send the signal to the phone.
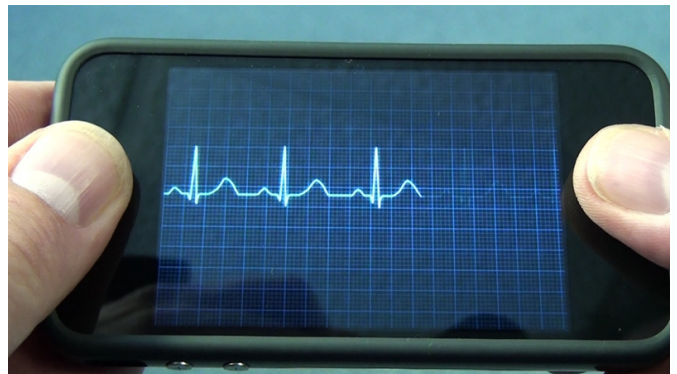2. A software app to receive, process and analyse the data and display the waveform.

Figure 2: ECG trace on a smartphone

Signal processing

The collected signals should be filtered, differentially amplified and digitised by circuitry within the SmartPhone case to produce the ECG signal. Full ECG generally requires a bandwidth of 50mHz to 150Hz.

The signal is sent to the phone by bluetooth. Further analysis of the ECG trace can be performed by software with the phone app, for instance to display heart rate or other key parameters from the PQRST waveform.

Further development of the software could enable the data to be sent to – for instance – a clinic or doctor's surgery for montiroing by healthcare professionals.

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