

DEVELOPMENT OF THREE LEAD HARDWARE SYSTEM FOR ECG EXTRACTION

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ABSTRACT

The human heart produces tiny amount electrical current during each beat. This tiny current is spread through out the human body and is detectable on the human skin. It is possible to record the heart activity by placing electrode on certain parts of the body. The recording of the heart activity is called electrocardiogram (ECG) and is represented in graph as voltage over time. In this thesis, the heart activity is extracted from the skin and displayed on the oscilloscope. Hardware is developed to acquire bio-signal on the human skin according to the Einthoven 3 lead method. Einthoven 3 lead method uses to 2 electrodes placed on three combination of location on the human body. The developed hardware consists of amplifier and filters. In contrast to the American Heart Association (AHA) which recommends a cutoff frequency of 100Hz for the low-pass filter; this project utilizes a 40Hz cutoff frequency low-pass filter for noise removal. The ECG signal extracted is compared, calculated its R-R interval for verification. The development of a 3 lead hardware produces an ECG signal that can be used for monitoring purpose. In general, the results ECG displayed from the developed hardware is similar to the ECG signal obtain when using the KENZ ECG machine.

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CHAPTER 1

INTRODUCTION

1.1 Background

Electrocardiogram (ECG) monitoring is normally performed in big hospitals as they required highly trained personnel to operate the machine and interpret the ECG. ECG is a graphical tracing or displaying of the electrical signal generated by the heart the muscle during a heartbeat.

This project mainly involves ECG signal acquisition using Einthoven technique. Willem Einthoven, developed the first Electrocardiograph (ECG) Machine. It was a simple string - galvanometer - capable of measuring small changes in electrical potential as the heart contracted and relaxed.

In his experiments, Einthoven realized that the potential at the wrist was the same as at the upper arm, while that at the ankle was the same as at the upper thigh. Einthoven consequently assumed that the functional position of the measurement sites of the right and left arm and the left leg corresponded to points on the torso which, in turn, bore a geometric relationship approximating the apices of an equilateral triangle. He further assumed that the heart generator could be approximated as a single dipole whose position is fixed, but whose magnitude and orientation could vary. The location of the heart dipole relative to the leads was chosen, for simplicity, at the center of the equilateral triangle. The signals were obtained from the two arms and left leg (modern Lead I), from the right arm and left leg (modern Lead II) and from the left arm and left leg (modern Lead III). This is also known as 3 lead ECG signal acquisition.