



University of Moratuwa

SIMPLIFIED BIOMEDICAL SYSTEM FOR ARTIFICIAL DEFIBRILLATION

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ABSTRACT

Many people all over the world suffer from heart ailments causing premature death in modern times due to stress poor eating habits and also due to hereditary factors as well. Severe changes for the heart beat pattern termed fibrillation is easily identified by using an Electrocardiograph (ECG). Of the two well known fibrillation conditions viz. Atrial and Ventricular, the latter is the worst just showing a zig-zag ECG pattern, causing death if not reverted back to normal as soon as possible. This reversing process is termed as defibrillation.

The defibrillator is an equipment designed to give a mild electrical impulse in case of atrial fibrillation and a large impulse of the order of several hundred joules in case of ventricular fibrillation.

The principle used in the defibrillator is to store energy by means of a capacitor and to give a shock in a single impulse through two electrodes kept on the chest of the patient.

It has been found that such equipment is too expensive and even ineffective for use in developing countries like Sri Lanka. This had resulted in a cardiologist requesting the university to fabricate an equipment which is not too expensive but will meet the local need. By discussing with a few cardiologists it was identified that it would be more appropriate to give a series of shocks at intervals first and if that does not work increase the energy of the next series of pulses.

Taking into consideration the above mentioned factors, a prototype of a defibrillator with advanced features such as effective ways of delivering shocks safe handling operational procedures and energy conservation was designed and fabricated the features of which are presented in this thesis.

In the existing defibrillators the energy stored in capacitors is emptied after giving a shock. This is similar to the situation that a water tank is emptied after taking some amount of water. It is more appropriate not to empty the tank at once but to use it several times and then refill it once there is insufficient water. This model simply put in to terms of 'water tank method' is used in the proposed defibrillator, where the energy remaining is not drained with one shock but after several shocks. Then only it is recharged.

The total system is a collection of several sub-systems such as a capacitor array for energy storage, high power MOS-FETs for charge drain & delivery of required amounts of energy, operational amplifiers for error checking, comparison etc. The 8051 microcontroller acts as the brain to the whole system.