Automated Tachycardia Treatment Via Jugular Venous Pulse Analysis

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Abstract-Bedside patient monitoring system is composed of the ECG waveform acquisition feature. Heart rate and other factors such as morphology of the waves lead to the conclusion of abnormalities such as heart blockage and tachycardia. In case of tachycardia, the physician is made alert by means of indications. Later, medicine is being manually injected at certain dosage levels according to the clinical situation. But this method is not much reliable as there might be presence of delays in medication. Moreover, during dialysis, association of the patient with too many electrically operated equipments make the process cumbersome and may lead to careless management. Thus, this project deals with the establishment of a model which configures the abnormalities in the jugular venous pulse which leads to tachycardia that can be treated by automatic infusion of medicine. Besides this, the system can be implemented in dialysis unit and ICU. This method also reduces workload on the medical staffs.

Keywords- Tachycardia, jugular venous pulse

I. INTRODUCTION

Heart disease is the most prominent cause of mortality, leading to 17.3 million deaths a year worldwide [1]. Various heart disorders have been diagnosed through sophisticated means originating in the biomedical field. One such means is the pressure wave analysis. It maintains accuracy in diagnosis and later the treatment is offered by the medical practitioner. Apart from ECG, the Jugular Venous Pulse (JVP) obtained from the patient's neck region gives a clear significance of the functions of the right atrium. It is useful in the differentiation of different types of heart disease. Till date, the JVP is only analyzed by means of a ruler and patient's head elevation is maintained at 45 degrees [2]. Photo plethysmographic imaging (PPGI) systems are non-contact bio photonic cardiovascular monitoring systems which provide non-invasive JVP analysis [3]. But this system is not affordable rather. In this project we extract the pressure waveform from the jugular vein, analyze the patient conditions accordingly and treat them. The project mainly focuses on the automated treatment of tachycardia, where the heart rate goes above 100 per minute via cannon "a" waves obtained from the jugular vein [2]. This project, apart from having automated medicine infusion systems, has additional alarm alert systems. This reduces the work of a physician or a nurse who is pressurized to look after a heart patient by constant manual injection of drugs to slow down the heart rate to normal levels. After the patient returns to normal state, the infusion stops and regular JVP monitoring continues.

II. METHODOLOGY

In the process of circuit designing, several components get involved. The primary objective is to detect tachycardia by means of analysis of pressure waveform from jugular vein in the neck region. The abnormal cannon 'a' wave is detected for the same. This also signifies other disorders such as heart block. Yet, tachycardia can be treated by automated infusion systems. Tachycardia is a heart disease, where the heart rate goes much above the normal (>100 beats/min) and this condition can be verified by usage of heart rate sensor, so that any other disorder need not be misinterpreted. The pressure wave analysis from the jugular vein becomes mandatory when critical situations arise, for instance, when there is an intense tissue damage in the wrists and fingers so that no heart beat sensors or pulse oximeters can be placed to analyze the pulse. In some cases, wounds will prevail that would impose much pain to the body during placement of these instruments. Moreover, ECG too does not provide accurate information about tachycardia. Timely prediction and diagnosis of the disease allows automated treatment and thus the patient can overcome threatening situations. A template of JVP for the disease condition is used.

III. SYSTEM DESCRIPTION

Fig 3.1: Block diagram

A. Bridge rectifier: It's the best accepted form of power supply mode so far the rectification process is concerned. The use of four diodes makes things very easy, just a single secondary winding of the transformer is all that is needed. The core saturation is perfectly optimized resulting in an effective AC to DC conversion. A full wave rectified power supply is made using four diodes and a relatively low value filter capacitor.

*B. Voltage regulator 7805***:** The voltage regulator reduces the impedance of the power feed. This also reduces input voltage fluctuations which can be seen as a function of current demand fluctuations. The regulator performs a better activity of keeping the output steady when the input is steady.

C. USB to UART converter: UART interface has a support for 7 or 8 bits of data and the data transfer rate ranges from 300 baud to 1 mega baud.

D. Timer circuitry: The LM555 timer is involved in the system to generate a trigger pulse when tachycardia waveform lasts for more than a minute the system so as to facilitate automatic medicine infusion to the patient.

E. Alarm circuitry: The circuit contains a transistor coupled to the micro controller board and the flow of current occurs in the transistor when a trigger pulse is generated by the timer. The emitter current activates the alarm.

F. PC: Used to display the jugular venous pulse wave.

G.16x2 LCD: The LCD displays the patient's condition, "normal" when the displayed heart rate is within range and "tachycardia" when the heart rate is above100.

H. Pressure sensor: This device senses the jugular venous pulse and allows the signal to get transmitted to be viewed over the PC.

I. Relay: It is an electrically operated switch that allows automatic infusion of drug during tachycardia and stops infusion when the normal condition is obtained.

J. LED: During normal condition, green light is displayed and during abnormal condition, red LED glows.

K. Heart beat sensor: It senses patient's heart rate.

L. Microcontroller: It is the heart of the circuitry that controls and automates processes.

IV. RESULT

The jugular venous pulse of the patient was analyzed and thus accordingly, the tachycardia was diagnosed and treated through automated infusion process.

Table 5.1 Tabular representation of patient data

Patient	*Heart rate*	*Condition*
P1	*78*	Normal
P2	*2*	Normal
P3	*69*	Normal
P4	*110*	Tachycardia

For tachycardia, automated infusion of drugs is carried out.

V. CONCLUSION

Thus the automated treatment of tachycardia though infusion of medicine was successfully accomplished and this process proves itself much more efficient than those processes which have ECG analysis indulged in detection and treatment. The methodology can thus be implemented so as to reduce medical workload.

VI. FUTURE SCOPE

In the future, several other existing disorders such as tricuspid stenosis, bradycardia, etc can be easily detected by means of the jugular venous pulse and this method, when implemented in the dialysis process of serious heart patients where jugular vein is the mode of blood extraction, can give accurate diagnosis and hence automated treatment can be processed.

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