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Automated Detection of Cardiac Arrest using Heart Beat Sensor and Provision of Therapy through Wearable Defibrillator

M. Gnana Guru[1]., S. Jothiraj[2]., M. Yogarajan[3]., Kumar Kandukuri[4]

Research Scholars, Department of Biomedical Engineering, Adhiyamaan College of Engineering (Autonomous) Hosur, Tamilnadu, India [1,2,3]

Assistant Professor, Department of Biomedical Engineering, Adhiyamaan College of Engineering (Autonomous) Hosur, Tamilnadu, India [4]

ABSTRACT: Coronary artery blockage or heart attack which leads to heart failure. The lack of blood supply to the heart leads to death. The people aged above 45 are prone to high risk of heart attack. A defibrillator can treat the heart block, currently, defibrillators are portable and automated. The existing Automated External Defibrillator used occasionally in ambulances to treat patients in the emergency. The proposed model is an Automated Wearable Defibrillator. The device consists of a flexible PCB, battery, relay, adhesive paddle electrode and an accelerated transducer. The project emphasizes the need to treat heart attack by means of automated shock therapy after troponin level analysis. Hence bringing out a much more level device compared to the previous technology. In such a condition, the proposed wearable device monitors the heart continuously and diagnoses the block. Electric shock is discharge as a therapy. This device hence proved to be much more efficient than the current one and seems to be an effective lifesaving equipment.

KEYWORDS: Heart, ECG, Diagnosis, Rhythm, Automated External Defibrillator (AED), Defibrillator, Sudden Cardiac Arrest (SCA).

I. INTRODUCTION

The defibrillator is biomedical equipment that is used to perform defibrillation on the fibrillated heart for the sake of correcting abnormal ECG rhythm. When heart enters into ventricular fibrillation, the process of returning it to its normal sinus rhythm by giving the proper amount of external electric current is called defibrillation, and device used in giving such electric current is called defibrillator. The evolution of defibrillator as a portable defibrillator. A portable defibrillator is designed to detect the irregular heartbeat based on the ECG waves and provide the required electricity in order to make the heart to beat normally again in a critical situation. Many people confuse the two as being one and the same, but they are drastically different. The only common denominator between a heart attack and sudden cardiac arrest is, they both involve malfunction of the heart. The heart requires blood from the arteries. When the arteries blocked by plaque and it blocks the oxygen supply is hindered the tissues become damaged. A heart attack occurs when one or more arteries become clogged and the heart is not receiving the oxygen it needs. Sudden cardiac arrest syndrome is not a result of clogged arteries, but it results from an electrical malfunction in the heart. There are no preexisting illnesses or symptoms to accommodate SCA. However, many heart attack victims have also suffered SCA during their heart attack. When Sudden Cardiac Arrest occurs, there exists a response that can save lives called defibrillator. High-sensitivity troponin (hsTn) assays that measure troponin have been the common procedure for nearly 30 years. They are part of some standard diagnostics, including electrocardiogram and coronary angiography, which aids the doctors to confirm a heart attack. But the high-sensitivity blood tests can measure very low quantities of troponin and can, therefore, tell doctors whether a patient is having a heart attack or not shortly after symptoms begin.

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Following the troponin test, it indicates the presence of heart attack to the patient. The AED is simplified as a wearable device. The proposed model based on the principle of the defibrillator. The function of AWD is the ECG electrode continuously monitor the arrhythmia of the heart. When the ECG electrode detects the abnormal waves or heart block. Relay turns on it allow the electric shock through the adhesive pads. The device is remarkable because it's not intended to provide too much or too little electricity.

II. METHODOLOGY

The proposed paper follows three stages in which include (A) Blood Test (B) Arrhythmia Detection (C) Defibrillator

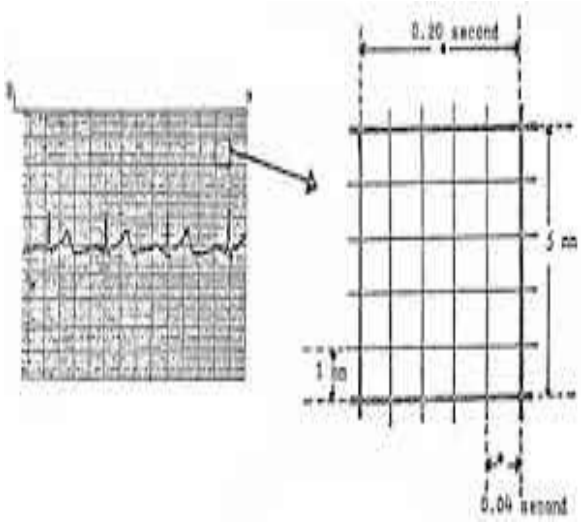
A. BLOOD TEST

The high-sensitivity assay is capable of measuring troponin tenfold lower concentrations than the existing method could perform. It takes only a few minutes for the proteins to leave the heart and get into the bloodstream, so this new test can tell us a lot sooner whether you're having a heart attack or not. greater prevention of cardiovascular disease. Even without having a heart attack, the higher levels of troponin may lead to heart failure.

Current Troponin Tests For Diagnosing Heart Attack Fall Short: Troponin levels are accurately measured in the existing methods in the blood about six hours after the onset of an injury so that measurements get more reliable. If a measurement is taken before six hours and it's negative, you can't be confident it's truly negative. The first test may miss it.If it's positive, you're done; it's easy. If it's negative, the patient has to wait for three to six hours and then repeat the test. If someone's troponin value is high the person is having a heart attack.

B. ARRHYTHMIA DETECTION

The methodologies to analyze the heart rhythm are as follows. The electrical activity of the heart is generated by the depolarization and repolarization of the atria and ventricles. The electrical activity of the heart is extracted by the ECG sensor with a surface electrode placed on the surface of the skin; the recorded electrical activity is connected with CRO. The time interval is the measurement of the each on the CRO. The wave has a certain time period and wavelength is marked on the each block on the CRO. The diagnose of the patient heart fairy accurate and measurements by counting blocks up and down on the CRO. The CRO records timesequences (horizontal) and amplitude (vertical) of the electrical activity of the heart. The horizontal linerecordtimeinterval and heart rate. Each of the small squareequal 0.4 seconds of time. 5 small squaresequal to 0.20 seconds-fifteen of the 0.20 squaresrepresent 35 seconds.



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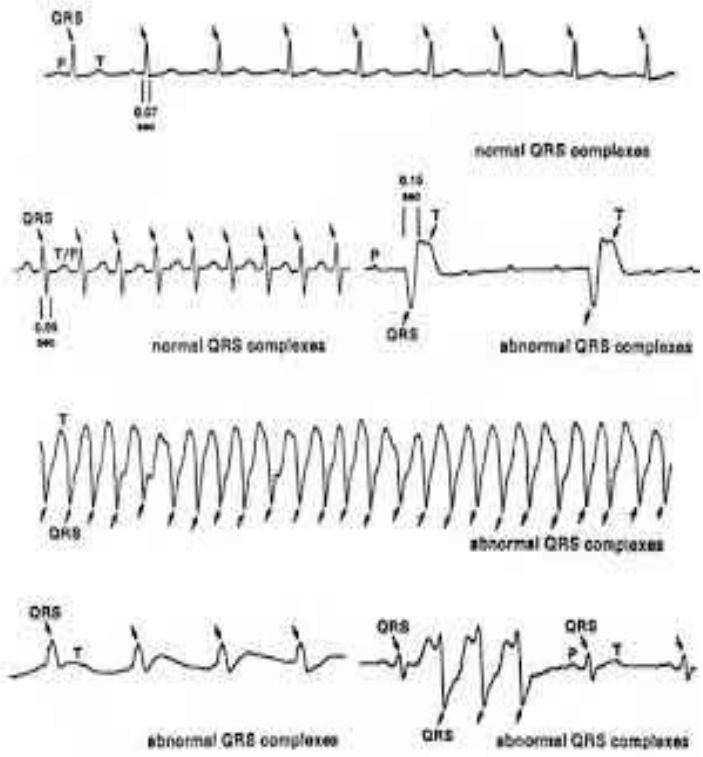
Arrhythmia: The arrhythmias of the heart rhythm can be defined as normal and abnormal rhythms.

Normal rhythm: In normal sinus rhythm a restingheartrate 60 - 100 bpm. In normal arrhythmia, the ECG wave consists of QRS complex. In the P-R interval should be 0.12 - 0.20 seconds.

P Wave: A normal sinus P waveindicates that the electricalimpulseresponsible for the P waveoriginate in the SA node. The P wave duration is 0.10 seconds or less. The amplitude of the P wave is 0.5 - 2.5 mm high. The shape is normally smooth and round.

QRS complex: QRS complex, the width of the QRS should be less than 0.12 seconds in duration. In normal P waverepresents the depolarisation of the right and left atria. effective; the heart rhythm is irregular.



T wave: T waverepresentsventricularrepolarisation the duration of the T wave is 0.10 - 0.25 seconds or greater. The amplitude of the T wave is less than 5mm.

Abnormal rhythm: An abnormal ECG is usually classified as due to slow or fast heartrate or an irregular beat. The abnormal heartbeat the QRS complex are irregular. The QRS identificationlead to figure out the abnormal waves as followed as the QRS complex duration and shape of the QRS complex may be normal or abnormal wavesareidentified by following the range 0.15 seconds or lesswide are normal, then abnormal waves are greater than 0.10 seconds wide and bizarre appearance.

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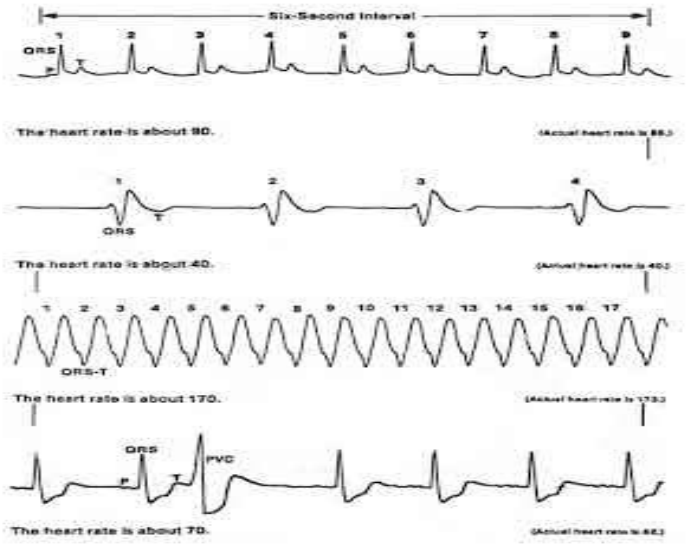
Heart rate: The abnormal wave has an irregular QRS complex. It causes difficult to identify the waves, so the heart rate calculations are used to determine the rhythm of the heart. The heart rate calculations are done by measuring the ECG wave in CRO is the number of ventricular depolarization or beats occurring in one minute.
To calculate, the heart rate is quite simple. The duration between two identical points R - R duration, the duration and divide into 60. To determine the heart rate the PP interval length is measured in the rhythm strip and multiply by 10 to



Number of Small Spaces:	Rate Per Minute
30	50
29	52
28	54
27	56
26	58
25	60
24	63
23	65
22	68
21	72
20	75
19	79
18	84
17	88
16	94
15	100
14	107
13	115
12	125
11	136
10	150
9	167
8	188
7	214
6	250
5	300

get the bpm. this method is more effective; the heart rhythm is irregular.

C. DEFIBRILLATOR

A wearable defibrillator consists of the battery, voltage regulator, relay, boost converter and adhesive pads. The battery supplies the voltage to Arduino board, it regulates the volt to the boost converter through the relay. The heart rhythm is continuously detected by the ECG electrode in which send the report to the relay. The relay turns on depending on the arrhythmia of the patient. The heart rhythm is detected as abnormal the relay turns on otherwise relay remains turns off. The relay turns on it supply the volt to the boost converter in which boost the voltage to the adhesive pads. The automated wearable defibrillator detects the irregular heartbeat and provides the required amount of electricity in order to make the heart beat normally again. The device is remarkable because it's not intended to provide too much or too little electricity.

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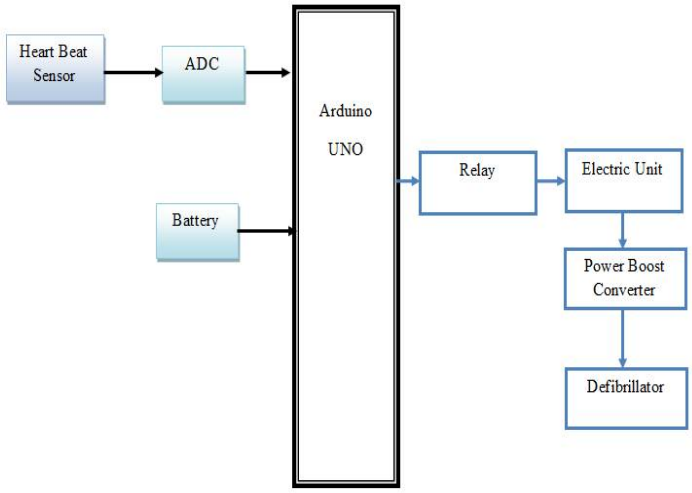
An automated wearable defibrillator is a required necessity to save a person who is prior to heart attack and also experiencing sudden cardiac arrest. This type of defibrillator defines the rhythm and allows shock application automatically, being independent of the patient whenever necessary.

III. SYSTEM DESCRIPTION



Heartbeat sensor: The heartbeat sensor comprises ECG electrode in which diagnoses the arrhythmia of the heart. For better extraction of the heart rhythm, the accelerated transducer is used. The heartbeat sensor is connected to the Arduino UNO board.

Arduino UNO: The Arduino Uno is a microcontroller board based on the ATmega328. Arduino Uno has 6 analog pins that are used as inputs and 14 digital pins which can be used both as input and output also it has the 16MHz oscillator. This can be connected to the computer via USB cable and can be powered. It can also be powered by an AC-to-DC adapter or battery.

Battery: Lead-Acid Batteries: Core of the battery is Gelled-electrolyte. The high impact plastic case is sealed the battery. The units are completely rechargeable and weigh 4 and 8 lbs. for the 6 and 12 VDC versions, respectively. The 6 V versionsare rated at 12 amp-hours and the 12 V version is rated at 10 amp-hours.

Analog to Digital converter: Analog-to-digital conversion is an electronic process in which a signal that is continuously variable with time is changed, into the digital signal. The input to ADC comprises of a voltage tends to theoretically the infinite number of values. Examples include sine waves, biosignals, human speech represented by waveforms, and the signals from the television camera. The output of the ADC, in contrast, has defined levels or states. The number of states is usually a power of two. The simplest digital signals have only two states and are called binary. All whole numbers can be represented in binary form as strings of ones and zeros.

Relay: Almost all the high-end industrial application devices have relays for their effective working. Relays are acting like a switch in both ways. Relays are incorporated with the electromagnet and few contacts. The switching mechanism is carried out with the help of the electromagnet. Its working can be explained by many operating principles. But they differ according to their applications. Relays have its own application on many devices.

Boost converter: The term DC stands for direct current, which is the unidirectional flow of electric charge. People use DC power sources such as solar cells, batteries, and thermocouples. DC is flexible and able to transfer through

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conductors, such as wire, as well as through insulators, semiconductors, and even through a vacuum. The current always flows in just a single direction, which is the thing that differentiates it from AC, or alternating current, which can change direction. The DC-DC converter passes the current to switching element This turns the signal into a square wave, which is actually AC. The wave passes through another filter, which turns into DC signal it provides the necessary voltage.

Adhesive pads: Self-adhesive defibrillation pads are to be removed from packaging and then pads are connected to conducting cables. If using paddles, connect paddles to monitor by inserting the adapter into receiving port identified on the manual defibrillator. The paddles must be applied with conducting gel or self-adhesive to ensure that the pads are moist with suitable conducting medium. The conducting gel may dry out and not perform properly If the pads were not properly sealed in the packaging. In this case, get a new set of pads. Apply paddles/pads to the chest. There are two placement options for defibrillating. With paddles, use the anterolateral placement.

1) Anterolateral: one paddle/pad is placed to the right of the upper sternum, below the clavicle (collarbone) and one paddle/pad is placed to the left of the left nipple where the center of the paddle/pad is adjusted in the midaxillary line (imagine a line extending down from the middle of the armpit.

2) Anteroposterior: One paddle/pad is placed over the left side of the chest, below the clavicle and the other is placed on the left side of the back below the shoulder blade and to the left of the spine.

IV. DISCUSSION

The automated wearable defibrillator aid for diagnosing the heart and it deliver the shock to the patient when it requires., and If you or your loved one is at risk for a heart attack, this may be an option for care in order to prolong the quality of life. An automated wearable defibrillator is designed to detect the irregular heartbeat and provide the required amount of electricity in order to make the heart beat normally again. The technology of these devices is remarkable because it does not provide too much or too little electricity. The wearable device of the system makes easy to carry everywhere. This technology is an enhanced methodology of previous techniques as it enables easy to handle.

V. RESULT

We use a battery of 120V and a relay of 5V whenever the relay is turned on, a voltage of 5V is supplied to the boost converter, which in turn provides 35V to the adhesive pads or multimeter for demo purpose.

VI. CONCLUSION

When a person suffers from SCA, there is not enough time to transport them to a hospital for treatment, or to a location where a defibrillator might be available. By having an automated wearable defibrillator, you treat a person anytime, anywhere. An automated wearable defibrillator should be readily wearing during a sleep and the physician effort reduced. Nobody knows when the sudden cardiac arrest will occur, and to be prepared is to save lives. An automated wearable defibrillator is a wearable machine that works just like any other medical defibrillator and its response can be immediate. An automated wearable defibrillator can be used by anyone, although it is recommended that someone who purchases should be trained. Defibrillators are easy to use and not intimidating.

REFERENCES

[1] Clement Neytonl, Sarah Menetre, Daniel Jost, Pulse Annotation of Automatic External Defibrillator Recordings During out of Hospital Cardiac Arrest, Paris, France, 2010.
[2] I.-H. Jang, H.-G. Yeom And K.-B. Sim, Ring Sensor and Heart Rate Monitoring System for Sensor Network Applications, 2008.
[3] Po-Hsiang Lai, Insoo Kim, Lightweight Wrist Photo Plethysmographyfor Heavy Exercise: Motion Robust Heart Rate Monitoring Algorithm Dallas, Richardson, USA, 2015.

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[4] Sami Alshorman, Fadi T. Jaber, FaycalBensaali, A Wireless Oxygen Saturation and Heart Rate Monitoring and Alarming SystemBased on The Qatar Early Warning Scoring System, Doha, Qatar, 2015.
[5] Zhihao Jiang, Houssam Abbas, Kuk Jin Jang, Marco Beccani, In-Silico Pre-Clinical Trials For Implantable Cardioverter Defibrillators, 2016.