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Detecting the elusive P-wave: A new ECG lead to improve the recording of atrial activity

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ABSTRACT

The lead selection method that was developed to detect the optimal bipolar electrode placement for the recording of the P-wave. The study population consisted of 117 lead Body Surface Potential Maps recorded from 229 healthy subjects. The optimal bipolar lead was developed using the training set then extracted from the testing dataset and compared to other lead systems previously reported for improved recording of atrial activity. All leads were assessed in terms of P-wave, QRS and STT root mean square (RMS).

Keywords: *Arduino, DC gun, Processing software, ECG lead*

1. INTRODUCTION

A Fundamental challenge in surface electrocardiogram (ECG) monitoring is to discern small but diagnostically relevant signals, such as P-waves, from background noise. Detection and analysis of the P-wave on the ECG allows for assessment of atrioventricular conduction and, as such, more accurate diagnosis of cardiac arrhythmias, in particular, atrial fibrillation (AF). Thromboembolic events such as transient ischemic attack (TIA) and stroke can attributable to AF. Strokes due to AF are common and can be devastating with approximately 70% to 80% of patients becoming permanently disabled or dying. These events are preventable with appropriate intervention. However, because AF is often sporadic, intermittent (Paroxysmal AF) and asymptomatic it can be difficult to detect using standard detection methods. The majority of automated AF detection algorithms rely solely on the analysis of R-R intervals. This can lead to false positives due to the presence of other cardiac conditions such as sinoatrial block, ventricular systole, ectopic beats and supraventricular tachycardia. An improvement in P-wave detection may lead to improved detection of atrial arrhythmias such as AF, atrial flutter, and atrial tachycardia. This has prompted renewed interest in patient monitoring technology, particularly Holter monitoring systems for 24-72 hour continuous ECG monitoring. Where signal information has been considered in lead selection most ECG lead systems have been optimized for the recording of ventricular activity. As a result, it is assumed that an optimized bipolar ECG lead could improve detection of the P-wave. Often P-waves from standard ECG leads are indiscernible from electrostatic noise as a result of incorrect skin preparation, patient movement or skeletal muscle potential. Traditionally, Holter monitors often rely on a reduced number of ECG leads for long-term continuous ECG monitoring. Single-Lead ECG systems have a higher patient acceptability when compared to 12-lead and 3-lead monitors due to the reduced number of electrodes and wires. However, this improvement in patient acceptability comes at a cost of a significant reduction in the ECG information.

2. EXISTING SYSTEM

12 Lead Can Improve Signal to Noise Ratio. This may improve the performance of detection algorithms that rely on p wave analysis. More time consumption. The automatic alert is not possible Possibilities for a traffic collision.

3. RELATED WORK

The project aim is to report on a lead selection method that was developed to detect the optimal bipolar electrode placement for the recording of the P-wave. The study population consisted of lead body surface potential maps recorded from healthy subjects. The optimal bipolar lead was developed using the training set then extracted from the testing dataset and compared to other lead systems previously reported for improved recording of atrial activity. All leads were assessed in terms of P-wave, QRS, and STT root mean square (RMS). The ratio was also investigated to determine the atrioventricular RMS ratio. Finally, the effect of minor electrode misplacements on the P-lead was investigated.

4. PROPOSED SYSTEM

Lewis lead is used to enhance the recording of atrial activity in the ECG. Lewis lead is useful in Recognizing P-Waves. ECG Gives an indication of The Heart Rate Faster than Pulse Oximetry. Easy to Use.

5. COMPONENTS REQUIRED

a) Arduino UNO:

The Arduino UNO is a microcontroller board with the implementation of ATmega328. 14 digital Input /Output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz ceramic resonator, USB connection, a power jack, an ICSP header and a reset button has been used here. It is

provided with everything needed to support the microcontroller. Simply connect it to a computer with a USB cable or power it with an AC-to- DC adapter or battery to get started. The Uno is the latest in a series of USB Arduino boards and the reference model for the Arduino platform.

b) Processing software:
Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts. Since 2001, Processing has promoted software literacy within the visual arts and visual literacy within technology. There are tens of thousands of students, artists, designers, researchers, and hobbyists who use Processing for learning and prototyping.

c) AD8232 ECG:
The AD8232 is an integrated signal conditioning block for ECG and other biopotential measurement applications. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. This design allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily. The AD8232 can implement a two-pole high-pass filter for eliminating motion artifacts and the electrode half-cell potential. This filter is tightly coupled with the instrumentation architecture of the amplifier to allow both large gain and high-pass filtering in a single stage, thereby saving space and cost. An uncommitted operational amplifier enables the AD8232 to create a three-pole low-pass filter to remove additional noise.

d) Relay:
A relay can be defined as a switch. Switches are generally used to close or open the circuit manually. The relay is also a switch that connects or disconnects two circuits. But instead of manual operation, a relay is applied with an electrical signal, which in turn connects or disconnects another circuit.

e) LCD:
A liquid valuable stone show (LCD) is a level board appear or another electronically balanced optical device that uses the light-tweaking properties of liquid diamonds. Liquid valuable stones don't release light direct, rather using a setting enlightenment or reflector to convey pictures in shading or monochrome. LCDs are available to show self-self-assured pictures (as in a comprehensively valuable PC appear) or settled pictures with low information content, which can be appeared or concealed, for instance, present words, digits, and 7-part appears, as in a mechanized clock. They use a comparative basic development; except for that optional pictures are included incalculable pixels, while distinctive features have greater segments.

f) Power supply:
A power supply is an electronic device that arrangements electric imperativeness to an electrical load. The basic limit of a power supply is to change more than one sort of electrical imperativeness to another. Along these lines, control supplies are now and again insinuated as electric power converters. Some power supplies are discrete, stay single contraptions, while others are joined with greater devices close by their loads. Instances of the last join control supplies found in desktop PCs and client equipment contraptions.

6. BLOCK DIAGRAM
Figure 1 shows the block diagram.

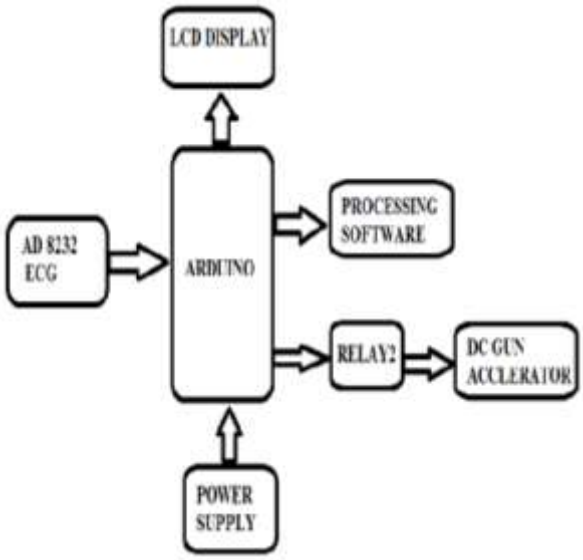

Fig. 1: Overall block diagram

7. OUTCOME

8. CONCLUSION
The optimized lead discovered in this research outperformed all other lead systems under investigation in terms of P-wave RMS. What remains to be tested is the performance of automated algorithms using the P-lead. It will be of interest to assess if improvement in previously described algorithms can be achieved using the P-lead, given the associated improvement in SNR. The close proximity of the identified electrode positions to the right clavicle and the costal margin is expected to allow for accurate electrode positioning in a clinical setting. However, even with small misplacements of the bipolar electrodes (<0.5 inches) a significant improvement in P-wave signal strength over all other leads is still achieved. The electrode positions discovered in this study may also provide better performance in terms of SNR during ambulation due to their central location of the electrode positions on the torso, away from moving body parts and large muscle groups.

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