

**REAL-TIME WEARABLE ECG SIGNAL ANALYSIS
FOR CARDIAC ARRHYTHMIA DETECTION**

By

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

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Cardiac arrhythmias are irregular heartbeats caused by malfunctions of the heart's electrical system. Usually harmless, arrhythmias can be predispositions to severe heart diseases. Since arrhythmia does not emerge in a short time, some indications might pass undetected during clinical electrocardiogram (ECG) tests. Therefore, wearable ECG with arrhythmia recognition is emerging. This research has succeeded to develop embedded software for arrhythmias recognition in real-time, such as irregular beats, premature ventricular contraction, premature atrial contraction, supraventricular tachyarrhythmia, and atrial fibrillation. The recognition began with acquiring ECG signal Lead I using a single-lead sensor. The main idea is to construct the algorithms that analyses the amplitude and duration of the P-QRS wave, in which contained useful information about the characteristics of each type of arrhythmias. The developed algorithm is a combination of Kim-Lee formula and Pan-Tompkins algorithm to precisely locate the Q-wave and S-wave locations as well as calculating the QS-interval. The software is then embedded to a wearable ECG and underwent performance tests by implementations onto databases and human subjects in a hospital with cardiac arrhythmia risk. The output is transmitted via Bluetooth Low Energy and displayed in smartphone applications. This method gave ease to both doctors and patients in handling arrhythmias.

Keywords: cardiac arrhythmia, real-time signal analysis, wearable ECG, QS-interval, smartphone.



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DEDICATION

Dedicated to those who suffers and rejoices;
fighting for a dream.



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Glory be to the Father, and to the Son, and to the Holy Spirit; as it was in the beginning, is now, and ever shall be, world without end.

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Through this thesis and research opportunity, I could now look at the world a little closer and find the beauty of life. Even more, I understand what I am capable of and how I can help the world with what I have. This has been a miraculous journey.

Sincerely,

Irena Sugiarto

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