

**FIRMWARE DEVELOPMENT OF BLOOD PRESSURE SIMULATOR:  
MINIMIZING THE EFFECT OF INFLATION AND DEFLATION RATE OF  
NIBP MONITORS TOWARDS SIMULATED OSCILLOMETRIC  
WAVEFORMS**

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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

### FIRMWARE DEVELOPMENT OF BLOOD PRESSURE SIMULATOR: MINIMIZING THE EFFECT OF INFLATION AND DEFLATION RATE OF NIBP MONITORS TOWARDS SIMULATED OSCILLOMETRIC WAVEFORMS

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Preliminary researches showed that a blood pressure simulator can be made using simple, cheap electronic components and works for both inflating and deflating type NIBP monitors. However, in the actual practice of the developed simulator, the simulator's program showed different results when it comes to different brands of NIBP monitor. This is allegedly due to the different characteristics, especially the inflation and deflation rate from each device that have not been analyzed yet. Thus, the effect of different rates of NIBP monitors towards the performance and the characteristics of blood pressure simulators were analyzed. The result showed that different rates do affect the characteristic and the output of the simulator. Therefore, a new simulator's firmware based on PWM values, rising, and falling slope was developed to minimize the effect, so the developed simulator could generate the same result for different types and brands of NIBP monitor. The results were good and have been validated with the results from a commercial simulator (FLUKE Biomedical) and the set value (blood pressure preset). The simulator was also evaluated in static and dynamic conditions to test the repeatability and stability of simulator's output. The results showed that the developed simulator is reliable enough to do quick accuracy pre-checks including assessing the repeatability of NIBP monitors.

*Keywords: Non-invasive Blood Pressure Monitor (NIBP), PWM, Blood Pressure Simulator, Oscillometric, Inflation Rate, Deflation Rate*



## DEDICATION

I dedicate this work to my family and friends.



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