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A Design Of Mini Doppler Detector Circuit System For Human Heartbeat Control

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ABSTRACT
Fetal Doppler is a tool used to detect the fetal heartbeat in the womb. This tool is widely used in maternity clinics or for mothers who want to hear the sound of the baby's heartbeat in their womb. With this tool, the development of the fetus in the womb can be monitored so that the health of the fetus in the womb remains healthy. The mini Doppler detector circuit has been successfully designed with the expected output results, namely being able to detect frequencies of 2 to 3 Hz. So this circuit can be realized for a mini doppler detector.

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INTRODUCTION

Since the beginning of pregnancy, it is highly recommended to have regular check-ups with the nearest obstetrician. During the check-up, the examination is highly dependent on the doctor and/or clinic concerned, but in general, the types of examinations carried out and indeed needed to ensure the health of the mother and baby during pregnancy until the delivery process are given here. One of these examinations is the Ultrasonic Wave Doppler Examination, this examination is carried out by placing the Ultrasonic Wave Doppler device on the stomach to capture the fetal heartbeat.

Fetal Doppler is a tool for detecting the fetal heartbeat in the mother's womb (Edward, 1958). Its use is to check whether the fetus is growing normally, indicated by its heartbeat. The use of this tool is very helpful in monitoring the development of the fetus so that the health of the fetus and mother is maintained properly. But not all pregnant women, health centers and midwife practices have this tool. because this tool is still produced/imported from abroad so it is expensive. The fetal heartbeat makes a sound (relatively weak), so actually by using a sensitive microphone, the fetal heart can be detected by amplifying the signal produced by the microphone. The problem is that close to the fetal heart there is also the mother's heart which produces a heartbeat that is stronger in intensity. The frequency of the fetal heartbeat is higher than the mother's heartbeat (the fetal heartbeat is 120-160 beats per minute while the mother's heart is around 80-90 beats per minute), so with the filtering technique, the mother's heartbeat can be filtered so that the fetal heartbeat is obtained. The purpose of this research is to design a mini doppler circuit which will later be realized into a mini doppler detector.

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METHODS

A filter is a circuit designed to pass a certain frequency band while attenuating all signals outside this band. The types of filters are low pass filters, high pass filters, and low pass filters. center and band-reject filters. In the mini doppler design, a center pass filter circuit is used. The global and comprehensive methodology of this research is shown in Figure 1. The prototype design of this mini Doppler consists of a sensor that captures sound/signal/microphone, a mid-pass filter, a pre-amplifier and an amplifier.

A microphone is a transducer that converts sound signals into electrical signals according to the sound patterns received. Given that the fetal heartbeat produces sound (relatively weak), then actually by using a sensitive microphone, the fetal heart can be detected using the signal produced by the microphone. The problem is, close to the fetal heart there is also the mother's heart which produces a heartbeat with a stronger intensity. However, because the frequency of the fetal heartbeat is higher than the mother's heartbeat (fetal heartbeat 120 - 160 beats per minute / beat frequency 2-3 Hz while the mother's heart is around 80 - 90 beats per minute), then to separate the frequency of the fetal heartbeat with the frequency of the mother's heartbeat, a Chebyshev middle pass filter circuit is used to filter the fetal heartbeat at a frequency of 2-3 Hz.

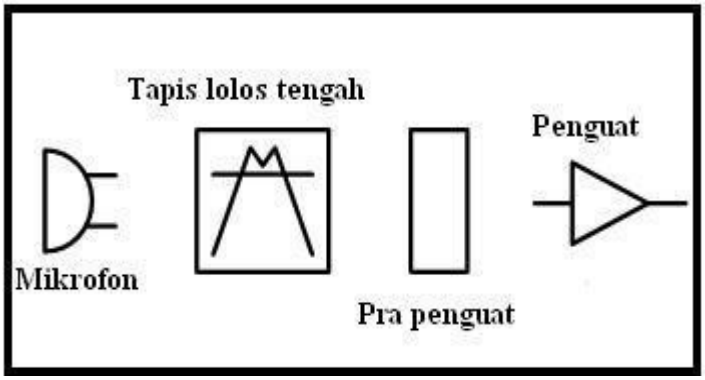

Figure 1. Mini Doppler Detector Block

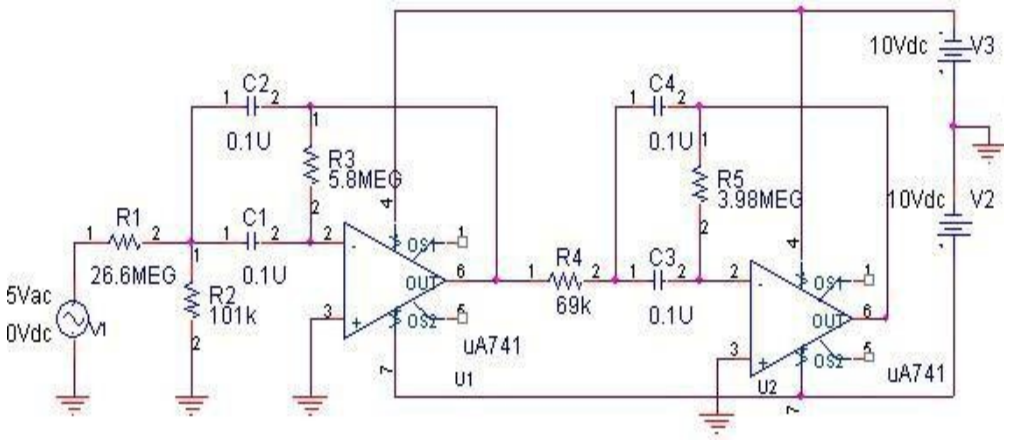

Figure 2. Central Pass Filter AssemblyChebyshev

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The output from the mid-pass filter circuit is forwarded to the pre-amplifier circuit which functions to increase the sensitivity of the sound sensor so that it is cleaner from noise, and its sensitivity can be easily adjusted (Figure 3). Furthermore, it is strengthened by using an amplifier circuit The output of the amplifier circuit is connected toa hearing aid. So that the mother can hear it directly. In Figure 4 is the form of a mini doppler that will be realized.

RESULTS AND DISCUSSION

Figure 5 is a picture of the overall circuit of the mini doppler detector consisting of a circuit: a mid-pass filter, a preamplifier and an amplifier. The simulation was carried out using the PSPICE application program. The purpose of this simulation is to find out the results of each part of the circuit and to ensure the accuracy of the circuit being tested.

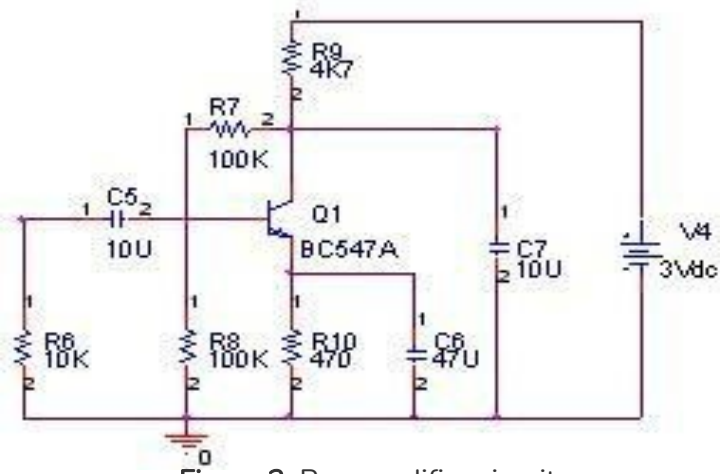

Figure 3. Pre-amplifier circuit

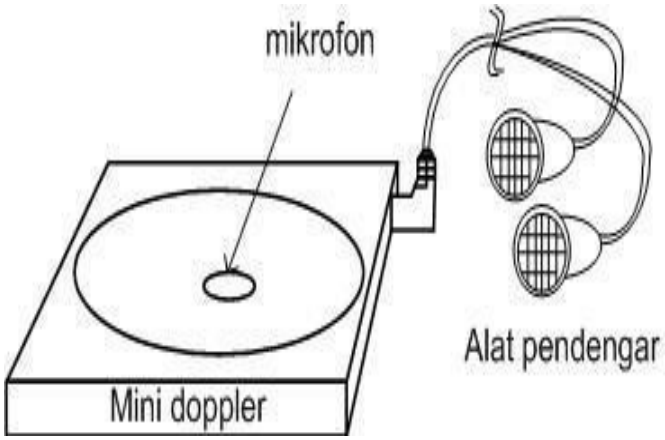

Figure 4. Mini Doppler Detector Prototype

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The output of the middle pass filter circuit filtering frequency 2-3 hz (Figure 6). The simulation results of the pre-amplifier circuit output produce as shown in Figure 7 while the simulation results of the amplifier circuit produce as shown in Figure 5.

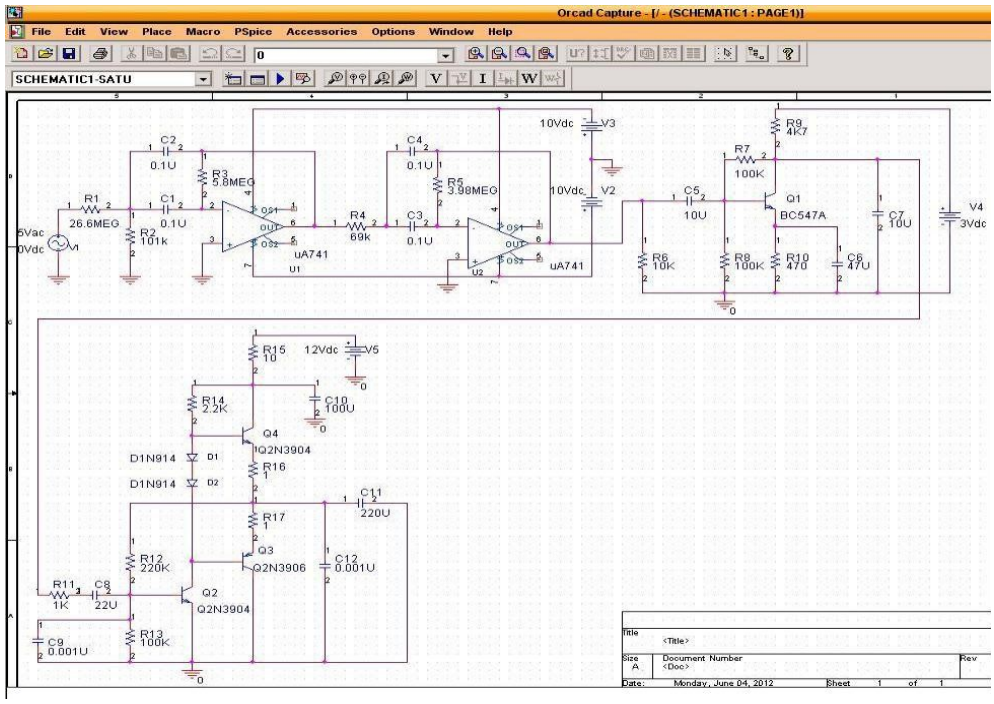

Figure 5. Mini Doppler Detector Circuit

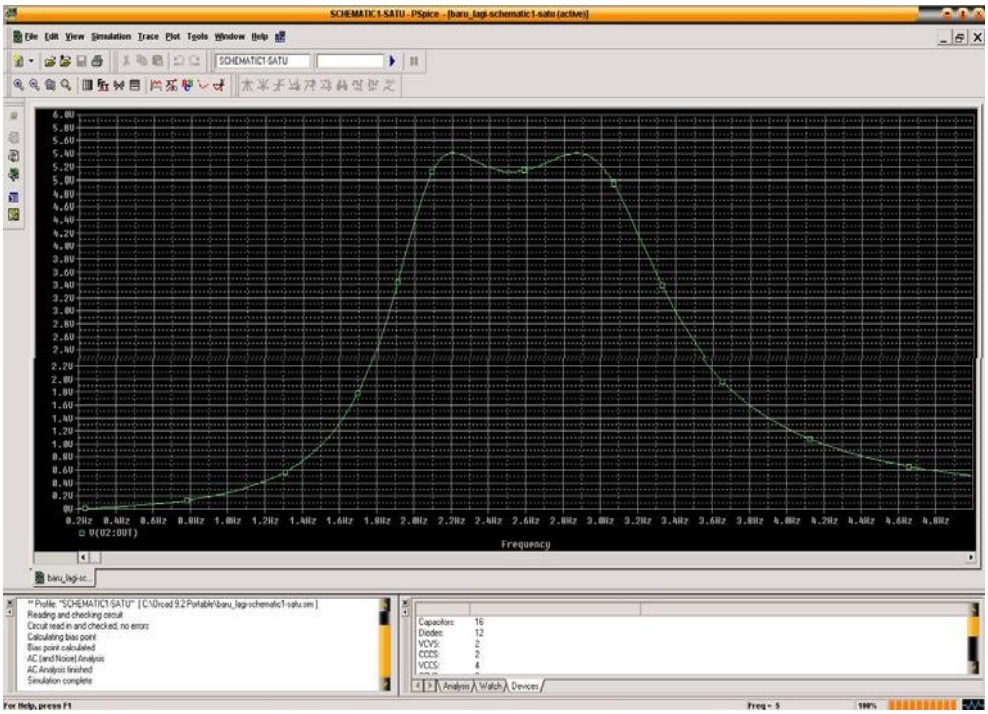

Figure 6. Simulation of the Output of the 2-3 Hz Chebysev Middle Pass Filter

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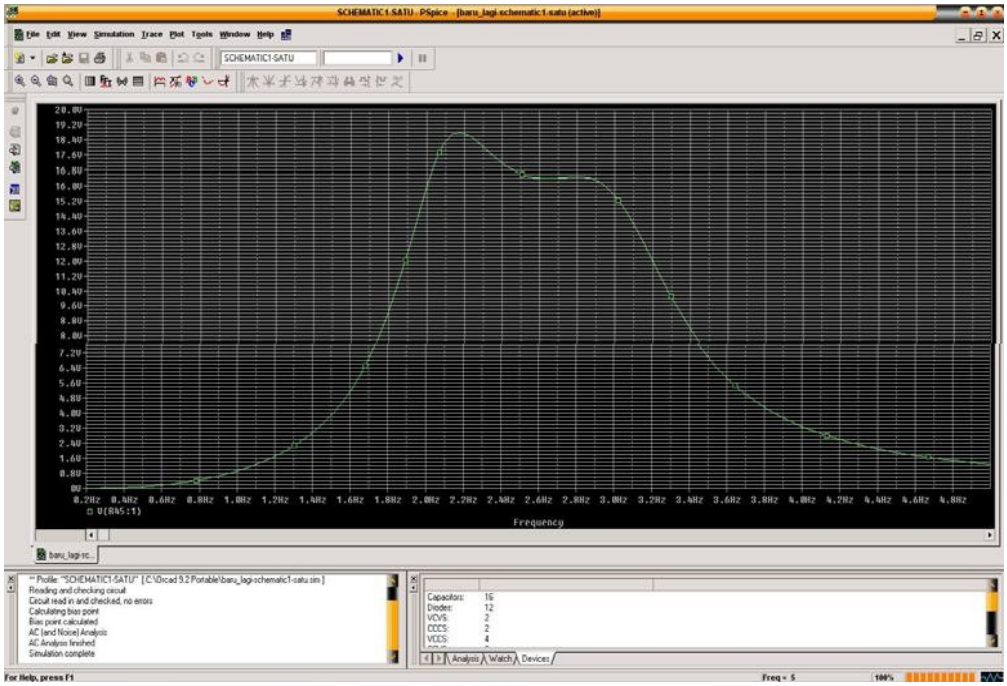

Figure 7. Pre-amplifier output simulation

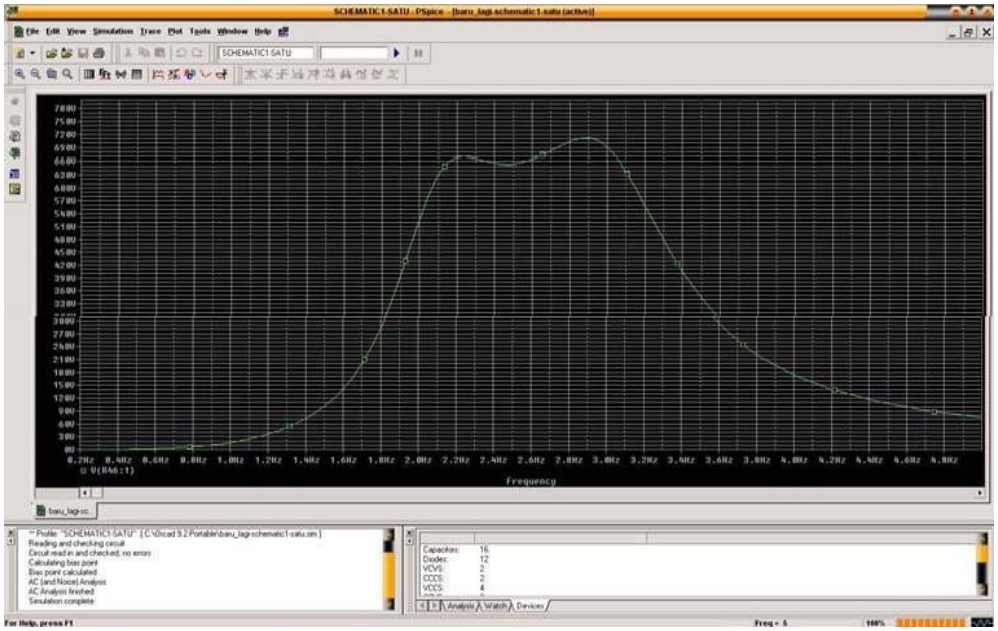

Figure 8. Amplifier Output Simulation

CONCLUSION

From the simulation results it is shown that the mini Doppler detector circuit produces the expected output, which is to detect frequencies of 2 to 3 Hz. With these simulation results,

this circuit is ready to be realized on a mini Doppler detector using components available on the market.

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