

Design And Simulation Of A Low-cost Digital Stethoscope

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Introduction: An affordable and user friendly digital stethoscope with wireless connectivity is envisioned as an extremely useful tool for heart patients. Our design couples the acoustic pressure from normal stethoscope to a smartphone microphone in an enclosure that is then digitized and sent to doctor for diagnosis.

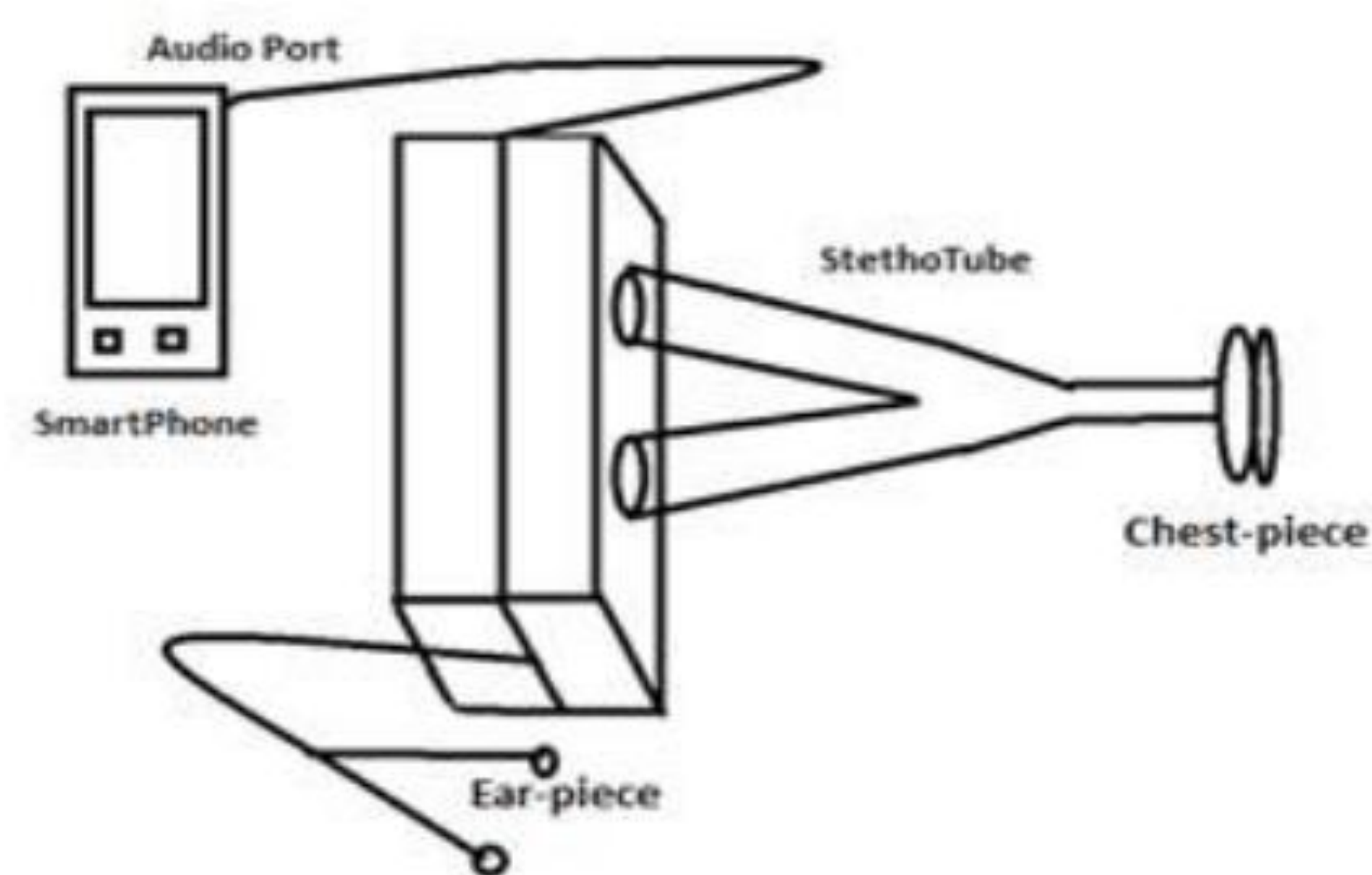


Figure 1. Basic design of the proposed stethoscope

Basic Design: Proposed design basically consists of a normal stethoscope and a smartphone microphone coupled in an enclosure box. The enclosure box accepts the two tubes from original stethoscope and hosts a microphone inside it to directly capture the acoustic pressure waves coming from the stetho-head via the rubber tubes. The enclosure isolates the background noise to enter the microphone and also makes it an easy to use.

Results: Figures below shows the response of the acoustic enclosure in the range of 10-400Hz and 3-4kHz respectively, which proves no sharp resonance is found in heart sound range (10-400Hz).

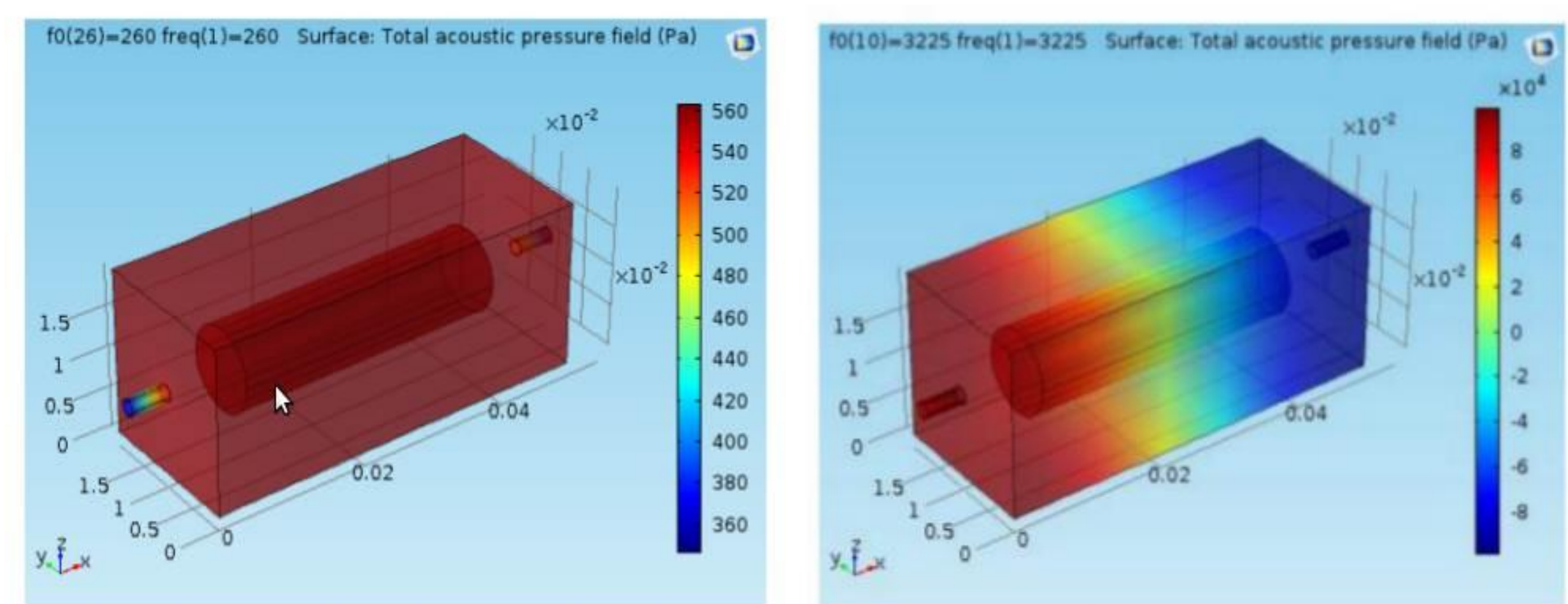


Figure 3.a. Acoustic pressure field at freq. 260Hz
b. Acoustic pressure field at freq. 3.2kHz

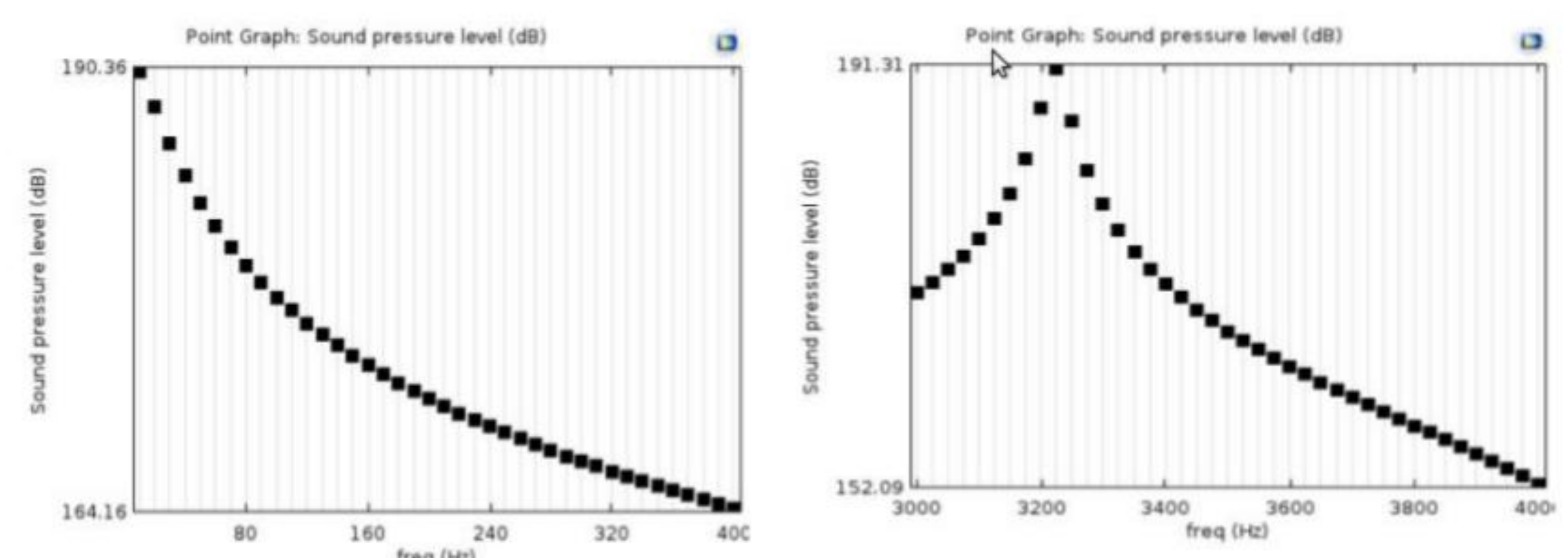


Figure 4.a Sound pressure (dB) Vs Freq. domain (10-400Hz)
b. Sound pressure (dB) Vs Frequency domain (3kHz-4kHz)

Conclusions: Our simulation ensures that the natural resonance frequency of the structure is way off from the heart frequency range and so it guarantees coupling of undistorted heart sound to the microphone.

References:

1. A.,Harsola, S.,Thale, et.al, Digital Stethoscope for Heart Sounds. In International Conference and workshop on Emerging Trends in Technology (ICWET).
2. Patent (CS) has been filed by TCS Innovation Labs Kolkata .

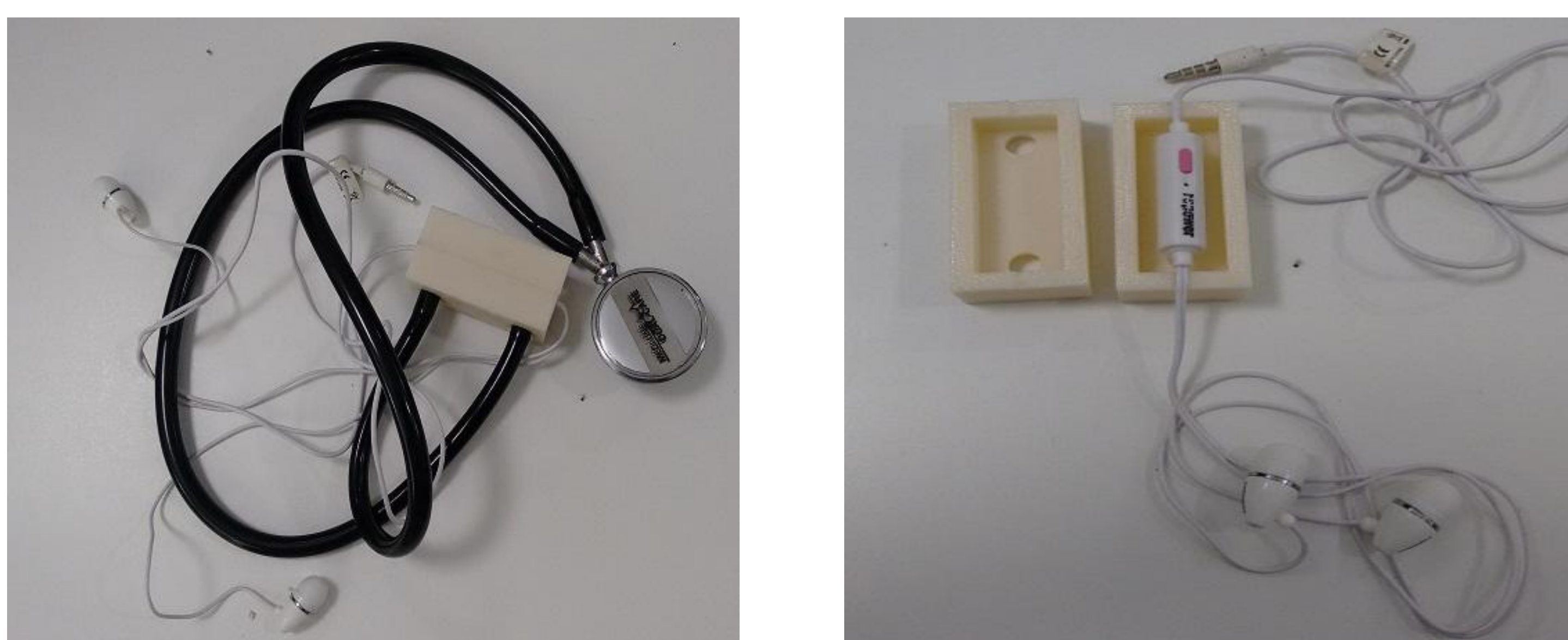


Figure 2. Our designed Digital Stethoscope