# 基于智能音箱的非接触心跳感知

Your Smart Speaker Can "Hear" Your Heartbeat!
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Motivation

☐ **Vital sign monitoring** is a common practice amongst medical professionals and plays a critical role in assisting clinical diagnosis, assessing the overall health of a patient.

☐ Traditionally, **dedicated equipment (PPG, ECG) operated by professionals** is used to monitor the vital signs.

☐ **Smart speakers** such as **Amazon Echo** and **Google Home** are becoming more and more popular in home environment. It was estimated that more than 200 million smart speakers have been sold until the end of 2019 and this number continues to increase every year.

☐ We envision that **smart speaker** becomes an platform to host this home health monitoring (respiration and heartbeat) application.
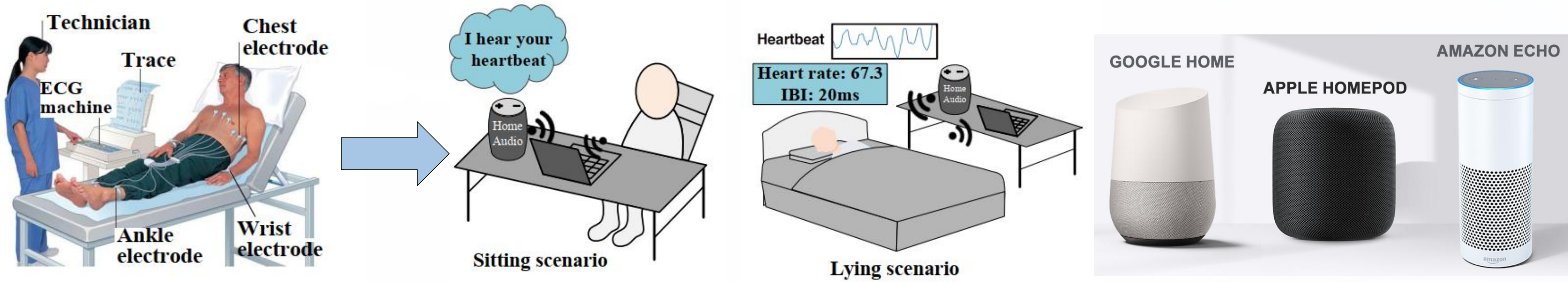
Overview of Heartbeat Sensing System

☐ Our system mainly consists of **two main modules**: FMCW signal processing and heartbeat extraction. The speaker transmits FMCW chirp signals. These signals hit the target, get reflected back and received by the microphone.

☐ **FMCW signal processing**: there is a **random time delay** from the signal is triggered to be sent until the signal is actually sent out.

☐ **Heartbeat extraction**: the heartbeat information and the respiration information, as well as the noise are **mixed together**.
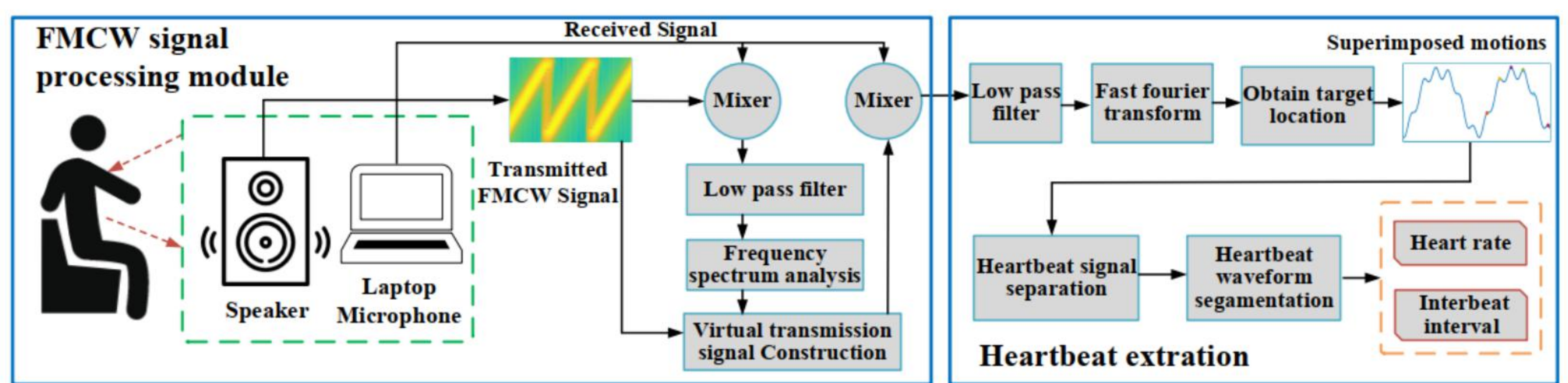
Evaluation & Results

☐ We implement our system using an off-the-shelf **smart speaker** (JBL Jembe, 6 Watt, 80 dB) and connect it to a laptop (MacBook Pro 2.6GHz with an Intel Core i7, 16 GB RAM) via the 3.5mm Audio Interface (AUX).

☐ We employ **a 3-lead ECG monitor**, i.e., Heal Force PC-80B to measure the ground-truths.

☐ We recruit eight participants including three females and five males in the age range of 10 - 65 to evaluate the effect of subject diversity. The participants are asked to behave naturally in **sitting and lying postures.**