

# Contactless Vital Signs Monitoring with Wireless Signals

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## PROBLEM STATEMENT

Vital signs, such as respiration and heartbeat, are useful to health monitoring since such signals provide important clues of medical conditions. Effective solutions are needed to provide contact-free, easy deployment, low-cost, and long-term vital sign monitoring.

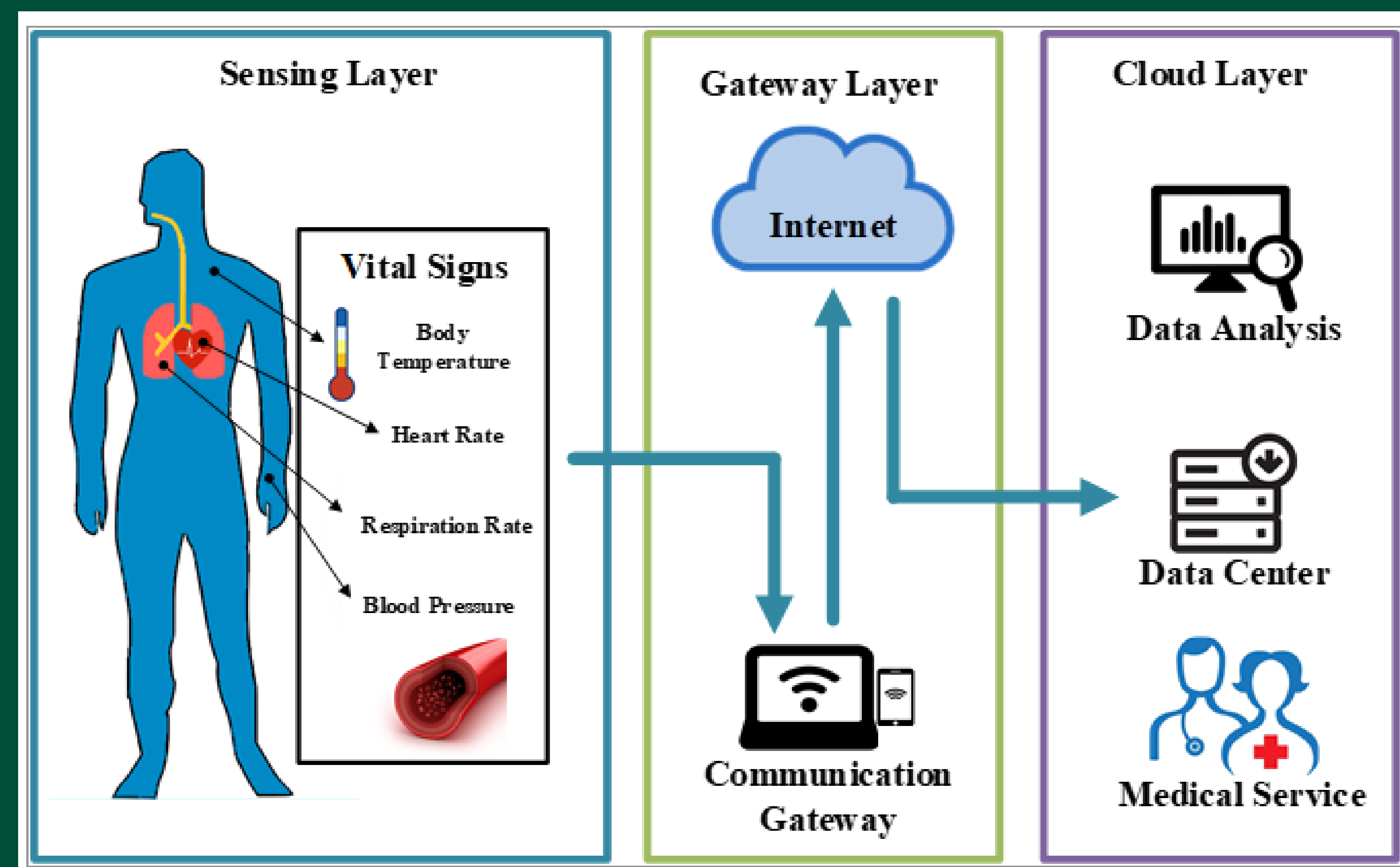


Figure 1: IoT-based health sensing system

## BACKGROUND

Existing contactless vital signal monitoring systems mainly focus on radio frequency (RF) based techniques, which use RF signals to capture breathing and heart movements.

- Radar based vital sign monitoring
- Wi-Fi based vital sign monitoring
- RFID based vital sign monitoring

Although RF based techniques can effectively monitor vital signs over a long distance for healthcare, RF based signals can be easily influenced by environment changes. We employ the sonar phase data with a smartphone to monitor the breathing signal caused by the rises and falls of the chest. Also, we also use Wi-Fi CSI to monitor breathing and heart rates.

## SUMMARY OF WORK

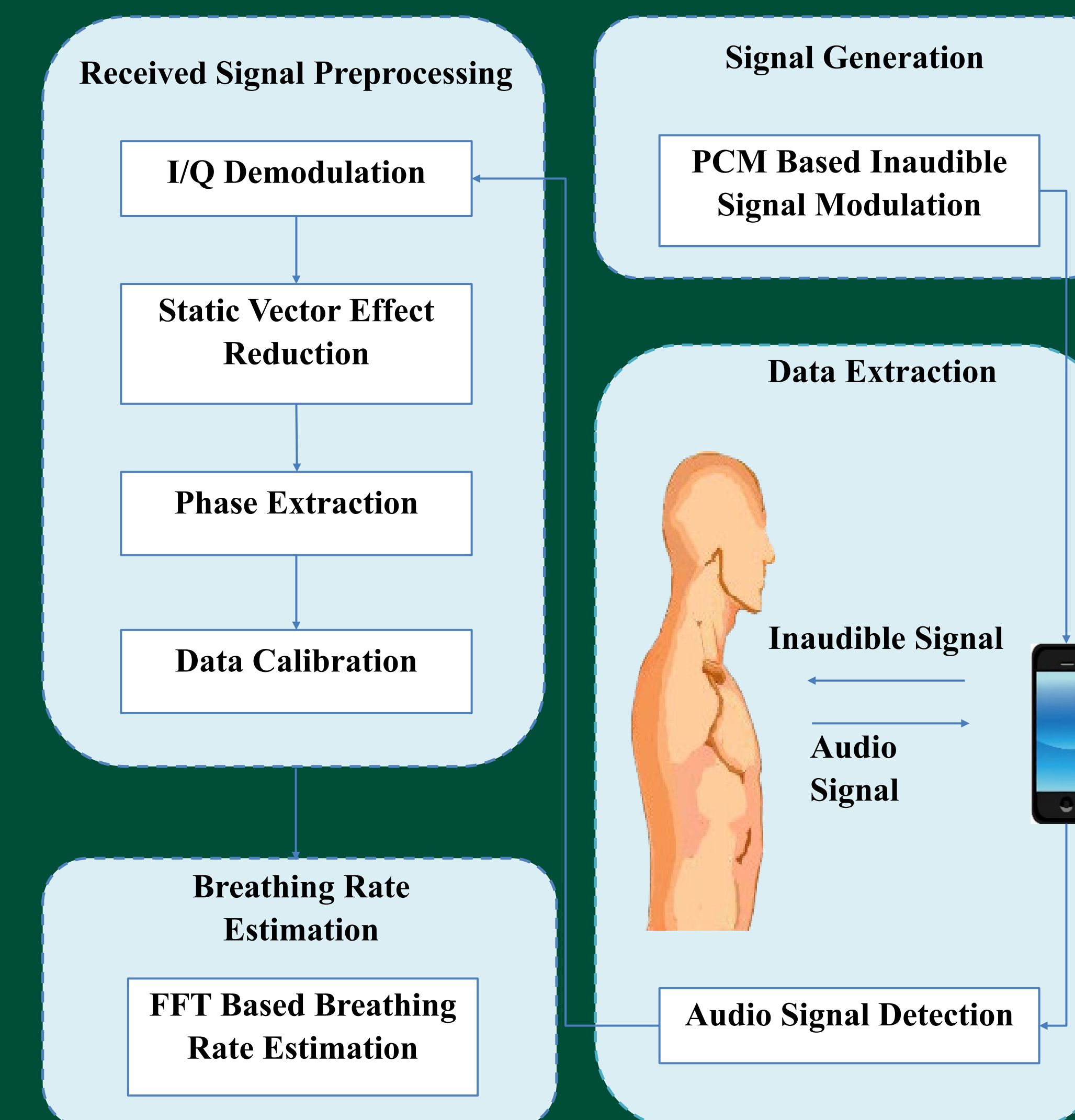


Figure 2: SonarBeat system

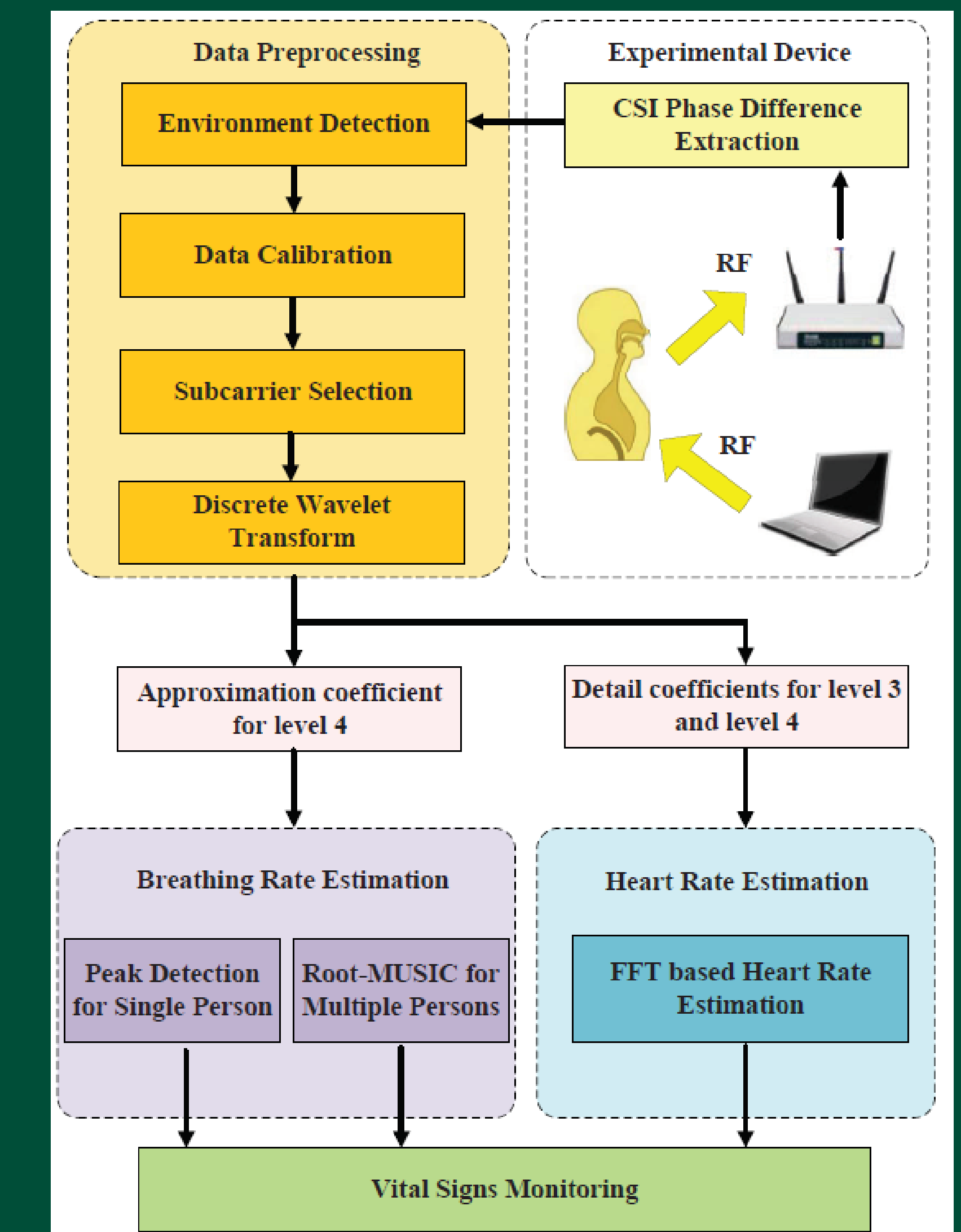


Figure 3: PhaseBeat system

## IMPACT ON COMMUNITY

It is reported that three-fourths of the total US healthcare cost are spent on treating chronic health conditions such as heart diseases, lung disorders, and diabetes. Contactless vital signs monitoring can offer important information for health problems such as sleeping disorders [1,2].

### References:

- [1] Xuyu Wang, Runze Huang, Chao Yang, and Shiwen Mao, "Smartphone sonar based contact-free respiration rate monitoring," *ACM Transactions on Computing for Healthcare*, vol.2, no.2, Article 15, Mar. 2021.
- [2] Xuyu Wang, Chao Yang, and Shiwen Mao, "On CSI-based vital sign monitoring using commodity WiFi," *ACM Transactions on Computing for Healthcare*, vol.1, no.3, pp.12:1-12:27, Apr. 2020.