Wireless Healthcare Using Sound Monitoring

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Abstract: According to findings of this article, the wireless healthcare system is suggested which makes use of wearable sensors to capture noises for the purpose of health diagnosis and monitoring. This may help to avoid the harm that can be done to human bodies by diagnostic equipment that utilize active power transmission, including X-ray scan as well as sound tracking, which are presently available on the market. The typical operation of the sensor for heart sound tracking is illustrated in this illustration. The sensor that has been created catches the sounds of the heart beating and may be utilized for both long-term heart rate monitoring and real-time applications.
Keywords: Wireless Healthcare, Sound Monitoring

I. INTRODUCTION

The noises produced by the human body offer a wealth of knowledge that may be utilized for illness detection and wellness monitoring. For instance, cardiopulmonary signals extensively utilized in hospital practice to detect lung and heart illness for many decades. It is essential to know fetal heart rate, which is determined by its sound since it is a crucial indicator of the baby's health. Likewise, the bowel sound may be used to determine whether or not the abdominal surgery was effective and there were no tissue adhesions [1,2].

People may now create unique sound monitoring and diagnostic systems that utilize various people's bodies noises, thanks to the expansion of digital signal processing and high-performance circuits. As a result, the whole sound-based diagnosis and monitoring do not cause either immediate or prospective harm to people's bodies instead of the widely used diagnostic instruments that employ dynamic power transmissions, i.e., ultrasound detection and X-ray scanning [3].

The article suggests a wireless healthcare sensor that captures the signals produced by the human body and uses it for diagnostic purposes and health monitoring. The sensors are typically formed of three components: the sound-sensor that wirelessly preserves the people's body, compact movable equipment that serves as a portable base station (PBS), then the server that commodities and manners the documented wellness data for the benefit of the end-users. With the advancements in sensor technologies, integrated circuits, mobile networks, and wireless communication, it can produce sound sensors that consume extremely little power, making them particularly proper for regular applications. This article is structured as: section II contains a description of the overall system design. A wearable sound sensor stick prototype for heart rate monitoring is detailed in section III, along with a description of the design.

II. SYSTEM ARCHITECTURE

In most cases, the suggested signals monitoring-based wireless healthcare operation consists of: i) the intelligent sound sensor is acontrollable sound tracking kernel unit ii) a PBS serves as a gateway to a vast area network iii) a remote server is plugined to PBS through a remotesystem and thenjoined to kernel unit (see Figure 1).

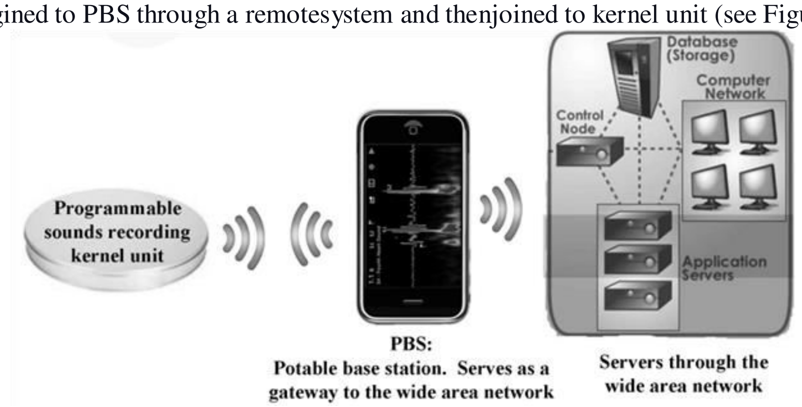

Fig. 1:A wireless healthcare structure based on sound monitoring

Among the system's essential components is the programmable soundtracking kernel unit which is presented in Figure 2. It consists of many components, including the controller, the sound sensors (small microphones), and the

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shortrange transceiver, which communicates between kernel unit and PBS; because of the use ofultra-low-power integrated circuits, high-integration, we can decrease the electrical component of kernel unit to a tiny fraction of the overall power used by the unit. As a result, depending on the application specifications, it combines the electrical sector with various prototypes and dimensions of the sound resonant chamber to operatemany sound trackers, including a tube-less stethoscope for monitoring or recording fetal heartbeats or bowel sounds, or a bandage-like sensor stick for recording cardiopulmonary sounds, among other things.

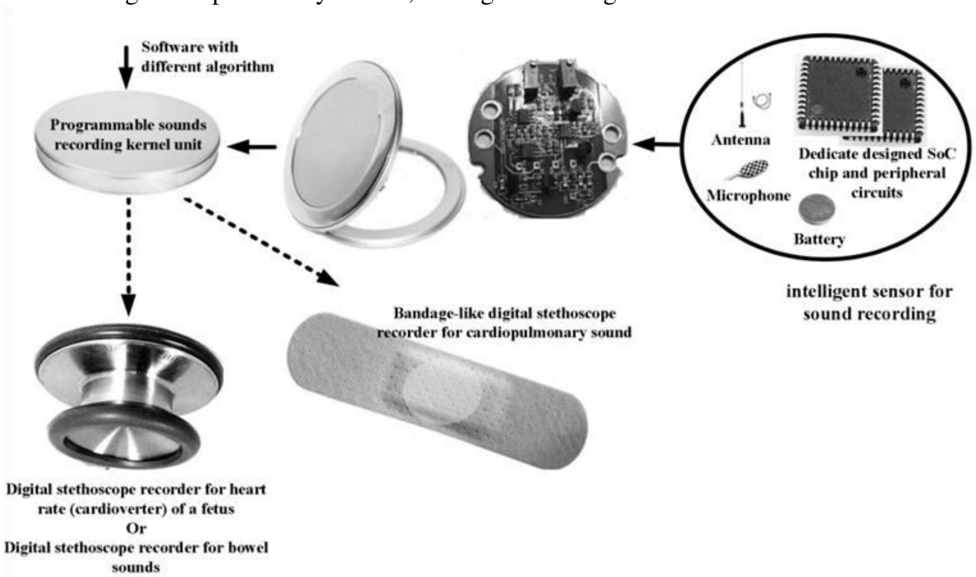

Figure 2: The sound recording kernel unit's architectural design

In order to capture the application requestes of regurlally usage and then lifetime projecting, sound tracking kernel units is designed to appropriate measurement precision, ultra-low power consumption, a compact form factors.

III. DESIGN OF A PROTOTYPE FOR THE MONITORING OF HEART RATE

As an illustration of how apresented sound-based wireless healthcare structure could be implemented, a ventricular sound trackingstructure for heart rate projecting is provided. For this reason, a design brief of the heart sound capturing and heart rate tracking process can be achieved in order to verify the suggested system design concept. There are three parts to it: a sound sensor stick that is attached to the people chest to capture heart sound, the smartphone whihc acts as a PBS, collecting data from sensor and displaying the heart rate data obtained from server, thenthe portable server connected to a wireless connection which holds the documented heart sound data and actually creates the heart rate detailed reports.

One of the most important components of this structure is a wearable signals sensor stick connected to the people's chest and used to capture heart channels. As presented in Figure 3, a sensor stick is made up of various important electrical components. A cardiac noises are picked up by the tiny microphone housed in a resonating chamber and converted into electrical impulses by the computer. A analog to digital (ADC) converter by controllable gain program transforms an analog sound signs that are received into digital sound signals that may be played back, and the flash memory is utilized to store a capture data on the sensor stick, which is located on the same board as the sensor. A microcontroller (MCU) is responsible for controlling the whole sensor stick. Transmitting sensor data and receiving instructions from the PBS are accomplished via an ultra-low-power transceiver (ULPT).

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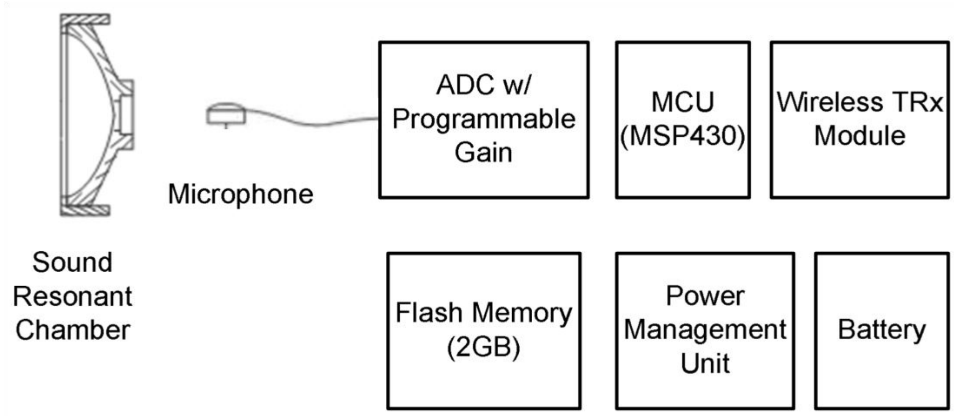

Figure 3: Circuit schematic of the heart sound sensor's electronic components

The paper proposes a signal sensor stick prototypewhich incorporates both a soft biocompatible casing and stiff electronic component (presented in Figure 4).

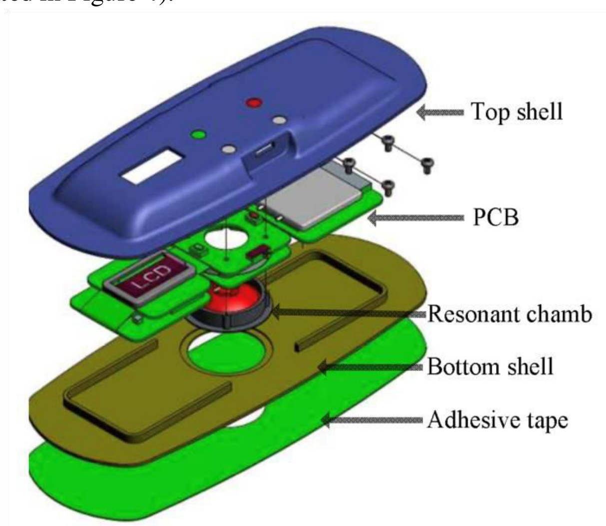

Figure4: Structure of a sensor stick for capturing audio.

All of the heart sound data that has been collected is transmitted to a distant server. The heart-rate computation method created in order to offer a more accurate heart rate measurement. As shown in Fig. 5, the raw data is treated using a Low-Pass filter, following is the most significant signal of a filtered signal in each cardiac cycle are determined (Figure 5-a). The duration of the cardiac cycles may be calculated, and a heart rate curve is producedusing this information. Themethod using signal of 120second heart sound is used to compute the heart rate curve[4] shown in Figure 5-b.

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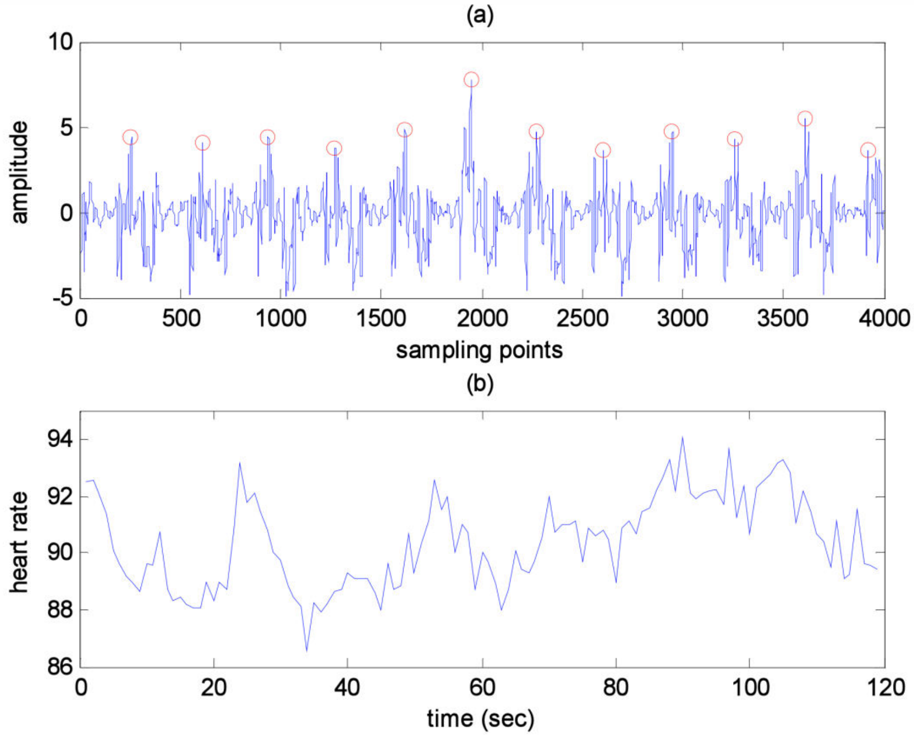

Fig 5:a) Filtering and detection of heart sound peaks in filtered heart sound signal (sampled at 500Hz). b) The heart rate was calculated to be approximately 120 seconds.

IV. Conclusion

The development of the wireless healthcare system depended on body sound monitoring is suggested for regular used and lifelongdiagnosis and health monitoring. In order to verify the system architecture, a prototype design for heart rate trackingis created and tested.This may help to avoid the harm that can be done to human bodies by diagnostic equipment that utilize active power transmission, including X-ray scan as well as ultrasound tracking, which are presently available on the market. A variousoperation of the sensor for heart sound projectingare illustrated in this illustration. The sensor that has been created catches the sounds of the heart beating and may be utilized for both long-term heart rate monitoring and real-time applications.

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