**Using Audio for Measurement of Heart and Breathing Rates for Health and Safety Monitoring**

**Abstract:**

This paper examines the integration of a non-invasive vital sign monitoring feature into the workers’ hearing protection devices (HPDs) by using a microphone positioned within the ear canal under the HPD. Breathe at various rhythms and intensities and these realistic sound events were recorded in the ear canal. Digital signal processing algorithms were then developed to assess heart and breathing rates. Finally, to test the robustness of theses algorithms in noisy work environments, industrial noise was added to the in-ear recorded signals and an adaptive de noising filter was used. Based on environmental sound the heart beat various to measure the value using ear phone This proof of concept enables the development of a wide range of non-invasive health and safety monitoring audio wearables for industrial workplaces and life-critical applications where HPDs are used.

**Introduction**

Heavy industries and confined spaces such as mines are hazardous and extremely noisy work environments in which work accidents and sudden ailments are more likely to occur. Improvements in occupational health and safety policies over the last decades and the number of mining fatalities has decreased significantly, from an average of 141 deaths in the 70’s to an average of 35 deaths per year in the USA from 2006 to 2010 [1]. The remote monitoring of workers’ vital signs could enable efficient paramedic interventions and further reduce fatalities for these industrial workers but also for other workers, including armed forces, first responders, firefighters and the like.

Non-invasive health monitoring methods already exist and are widely used in clinical applications to monitor physiological parameters such as heart rate or breathing rate. Systems such as electrocardiography, stethoscopy, plethysmography, and spirography are extremely accurate but often cumbersome and only used in controlled environments. More recently, several connected wearable devices have been developed to monitor heart rate or breathing rate: watches, shirts, wrist bands or belts. However, those wearable are not appropriate for monitoring the vital signs of workers in the industries mentioned. Most wearables are not designed for the rough environments these workers are exposed to and are not designed to be compatible with the personal protection equipment (PPE) that these workers are likely to already wear. Interestingly, one of the most used PPE is the hearing protection device (HPD), which is used to protect workers from toxic noise and also sometimes, in its electronic version, to communicate over personal radio in very noisy environments.

**Existing system**

The existing either the validation has been conducted on very limited data, or the experimental protocol is not explicit, or the recorded signals are not representative of real-world conditions. Furthermore, the microphones used in these studies are located on the trachea or on the chest. Consequently, the measurements are exposed to ambient noise, which may alter the signal being measured. To address this problem, the microphone can be located behind an earplug to take advantage of its passive acoustic attenuation. However, no specific algorithms were developed to extract the breathing rate. Moreover, the total duration of the recorded signals is short and the hardware used for acquisition is now obsolete. To the authors’ knowledge, no other research has been conducted to extract heart and breathing rates from an in-ear acoustic measurement. Therefore, no database currently exists of sounds measured in the ear canal with signals sufficiently long in duration and representative of real-world conditions.

**EXISTING SYSTEM DISADVANTAGE**

* No other research has been conducted to extract heart and breathing rates from an in-ear acoustic measurement.
* No database currently exists of sounds measured in the ear canal with signals.
* No specific algorithms were developed to extract the breathing rate.

**PROPOSED SYSTEM**

Therefore, a promising solution to monitor the vital signs of the workers mentioned would be to directly integrate such bio signal monitoring system within an electronic HPD, by taking advantage that these HPDs are often already equipped with external and internal microphones [2]. Using such hardware and some digital signal processing (DSP) the envisioned in-ear audio wearable device could capture the physiological noise resulting from cardiovascular activity (and highly correlated with heartbeats) as well as from respiration using a small microphone positioned inside the occluded ear canal. In the proposed system we monitor the heart beat and breathe rate using Arduino .By using microphone the environmental sound we get. Based on environmental sound our heartbeat rate will change, so we can monitor the changing value of heart beat.

**Block diagram**

GSM/ZIGBEE

Resipiratory

sensor

LCD

Arduino uno

Microphone

Heart Beat Sensor

PROPOSED SYSTEM ADVANTGE

* It remove the noise from measuring the heart beat in industrial environment.
* It increases the efficiency of measuring heart beat and breathe rate in industrial environment.
* It reduce the error rate in measuring the heart beat and breathe rate.

Hardware requirement

* Arduino
* Heart beat sensor
* Respiratory sensor
* Microphone
* Zigbee/gsm

Software requirement

* arduino