Chapter 7

Review on recent wearable technology for respiration monitoring

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Abstract

Respiration is one of the most vital parameters of human body. The advancements of the technology had improved the way of detecting the respiration through wireless technology. The wireless technology mainly uses wearable and portable sensors which has its unique featured properties in monitoring the respiration rate. The proposed review paper describes the recently discovered wireless technology the has improved the continuous monitoring of respiration rate based on the angular velocity, flexible capacitive pressure sensor and non-contact capacitive electrode. The working principle of all the determined technologies varied based on the types of sensors used to monitor the respiration rate

Keywords: wearable technology, respiration monitoring, inertial sensor, flexible capacitive pressure sensor, non-contact capacitive based electrode.

INTRODUCTION:

The development of current technologies has been improved more faster in the field of healthcare. Monitoring the vital parameters of

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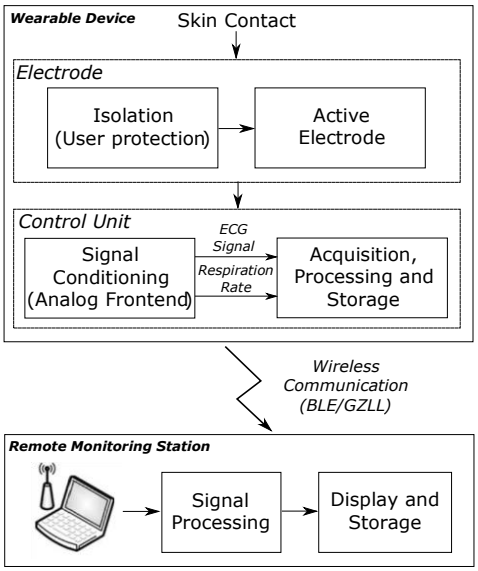
human body accurately in motion or during daily activities are challenging tasks in present life. Respiration is one of the important parameters of human bodies which is monitored continuously to detect sleep disorders (i.e., sleep apnea) and asthma which is common respiratory diseases in the world. The proposed review paper describes the working and the principles used for monitoring the respiration rate by using different types of sensors.

LITERATURE REVIEW:

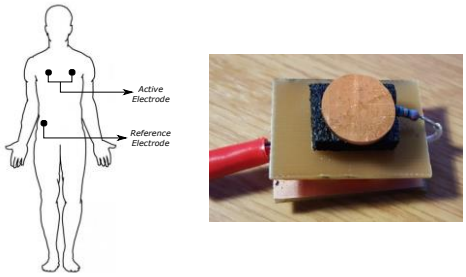
Wireless Capacitive Based ECG Sensing for Feature Extraction and Mobile Health Monitoring by Johan Wannenburg:



In this paper the author have designed a wireless device which is capable of monitoring both ECG and respiration rate(RR). The monitoring system uses contactless capacitive based electrode which is an active electrode and an analogue conditioning circuit. The signals are transferred from device to mobile using BLE(Bluetooth technology). BLE uses low power communication with the remote server. The introduction is basically about the ECG and RR which helps in understanding the needs of the parameters to develop this wearable device. Overview of this paper defines complete hardware

properties of the wearable device.

The device is responsible for monitoring ECG and RR by using two sub systems. They are wearable device and remote monitoring station which uses Bluetooth technology. The device is battery powered and capable of transmitting the acquisition data to the remote monitoring systems.



The device set up is made in such a way that the extraction of ECG related features and RR can be monitored with a complete protection using isolation. The electrodes are place in chest using a strap which measures both the parameters through capacitively coupled signals. The signals are acquired in analogue signal and converted into digital signals using ADC. Then the signals are transferred to remote monitoring systems and observed by physician. The devices transmit both parameters to remote monitoring system but the author aims in developing this device as a promising one to monitor accurate data in future.

A Novel Signal Acquisition System for Wearable Respiratory Monitoring by Guo Dan:

In this research article, a new method of obtaining the respiratory sensing for monitoring the continuous acquisition of respiratory signals based on the angular velocity. The sternum or breastbone and the trachea of both male or female is the suitable area for placing the wearable device due to its insensitivity. The respiration detection

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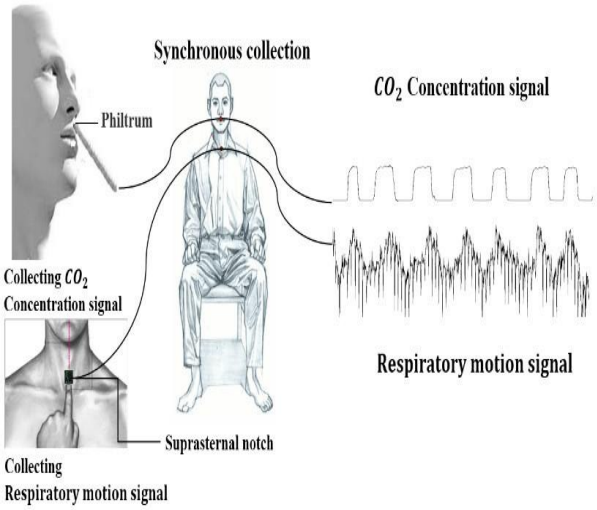
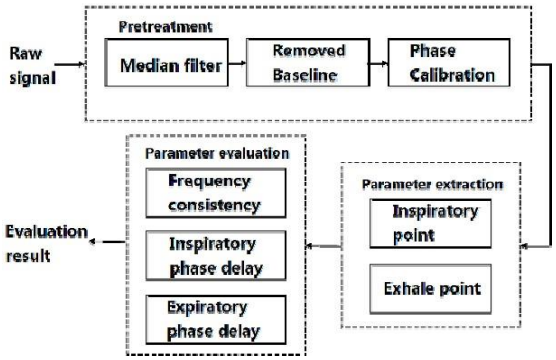
mechanism of the wearable device works under the Euler's angle formula which finds out the exact position of the fixed-point rotation from the number of parameters namely pitch angle, roll angle and the yaw angle. The experimental set-up consists of two test-beds in which the first test-bed is a inertial platform and the second test-bed is a carbon-dioxide (CO2) concentration setup. The CO2 concentration is used to sense the accuracy of the inertial sensor platform because it is considered as gold standard reference for synchronizing the acquisition of both former and later platforms. RESPLIVE/TiniStream module from Witleaf Co.Ltd., is used in CO2 concentration platform for opening the path for signal acquisition from port to PC at sample frequency of 25Hz. The inertial sensor platform uses INVENSENSOR MPU6050 which is small, low-cost and power efficient. The sample frequency of inertial sensor platform is double than that of CO2 concentration platform (i.e. 50Hz).



The inertial sensor in placed on the targeted area by using a double-sided tape. A nasal cannula is directly placed below the nasal cavity for detecting the air flow. The acquired data is transmitted from device to the PC. The test was done on 10 healthy subjects which includes 5 males and 5 females. Single channel angular velocity module

collected the respiratory signal from the targeted area in which it showed three unique frequencies. They are normal, high and low frequency. These unique frequencies analyses the respiration rate (i.e., breath at normal frequency shows 0.25Hz, at high frequency it shows 0.4Hz and at low frequency it shows 0.15Hz). The two steps algorithm is discovered in this paper. Preprocessing is done to eliminate noise and phase differences. Calculation of respiration parameters like inspiration and expiration is performed in the second step. Comparing with the tradition method which uses a nasal cannula for detection the respiration signals, the proposed wearable method provides more comfort to the patient.



CONCLUSION:

In this paper wearable technology which uses inertial sensor, flexible capacitive pressure sensor, non-contact capacitive based electrode for monitoring the respiration rate or respiration signals have been reviewed. The specifications and working of device changes based on the type of sensor used. The reviewed papers show's faster acquisition of respiration signals in motion. The further approach will be done on wireless technologies which are used for monitoring respiration in motion will be studied and reviewed in future.

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