DESIGN OF STRESS MONITOR USING WEARABLE MEDICAL TECHNOLOGY

[1] P.U.ILAVARASI, [2]S.PADMA, [3] R.THENNARASU, [4]R.ARAVINDHAN
[1,2]Assistant Professor, Department Of EIE, Velammal Engineering College, Chennai-66
[1]ilavarasi@velammal.edu.in, [2]padma@velammal.edu.in

ABSTRACT

Stress is one of the major cause of concern in the present world. Long term exposure to stress leads to health problems. Respiratory rate is one of direct measures which contribute information whether the person is stressed. This paper deals with the design of stress monitor based on respiratory signals measured by respiratory belt to make the stress monitoring process relatively cheap and accurate. The respiratory belt consists of piezoelectric sensor which is very helpful in monitoring respiratory signals. The respiratory belt is placed on chest to pick up the respiratory signals and convert it into voltage. This obtained voltage signal from the respiratory belt is interfaced with laptop. A LabVIEW program is used as user interface in laptop. Now the graph is displayed on the LabVIEW based on respiratory signals and hence the stress is monitored by comparing the respiratory signals at different circumstances.

Keywords : Respiratory ,piezoelectric ,LabVIEW.

I .INTRODUCTION

Exposure to long periods of stress is associated to health problems like exhaustion syndrome, cardiovascular and metabolic disturbances, as well as neck and shoulder problems. Respiratory rate, heart rate, and the variability in heart rate are other direct measures that contribute information about to what extent a person is stressed or not Recent development in medical technologies has presented respiratory belt that incorporate piezoelectric sensors. The respiratory belt has been developed and applied for the medical and health care purpose to monitor physiological parameters like respiration. Stress monitoring is important to determine whether the person is normal or not. Stress monitoring using respiratory belt is one of the easiest and cheapest way to determine the same.

II .LUNGS

The lungs are the primary organs of respiration in humans and many other animals including a few fish and some snails.In mammals and most other vertebrates, two lungs are located near the backbone on either side of the heart. Their function in the respiratory system is to extract oxygen from the atmosphere and transfer it into the bloodstream, and to release carbon dioxide from the bloodstream into the atmosphere, in a process of gas exchange. Respiration is driven by different muscular systems in different species [2]. Mammals, reptiles and birds use their musculoskeletal systems to support and foster breathing. In early tetrapods, air was driven into the lungs by the pharyngeal muscles via buccal pumping, a mechanism still seen in amphibians. In humans, the primary muscle that drives breathing is the diaphragm. The lungs also provide airflow that makes vocal sounds including human speech possible.

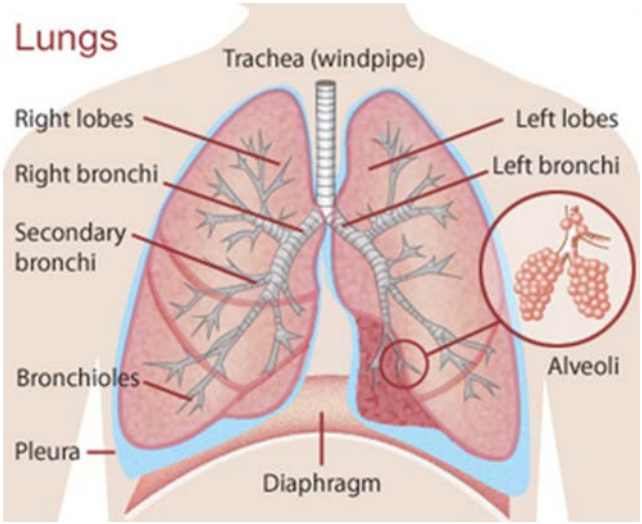

Fig 1 .Anatomy Of Lungs

III . OBJECTIVE

1) To design a stress monitoring system based on respiratory signals measured by a respiratory belt.

2) To design a portable interface unit.

3) To design a stress monitor with low power consumption.

4) To enhance real time monitoring of respiratory signals and to improve the mobility of the system.

IV . HARDWARE DESCRIPTION

HARDWARE COMPONENTS:

- Respiratory Belt
- Arduino Duemilanove with ATmega 328
- Personal Computer

1. Respiratory Belt

The beeper made of piezoelectric material could be easily modified to function as a respiratory belt transducer to monitor respiratory movements. After modification, the beeper was attached to the chest using Velcro straps. The strain induced on the piezoelectric material of the beeper by the chest movement produces a corresponding voltage change, which can be recorded by a computer using data-acquisition systems or observed using an oscilloscope.

Materials needed. The following materials are needed for the construction of the respiratory belt transducer

- Beeper of a singing greeting card or buzzer (2.5cm in diameter)
- Velcro strap (60 cm long and 2.5 cm wide)
- Latex strip (25Ð30 cm long and 2 cm wide)
- Copper wire (1Ð2 mm thick)
- Fast curing epoxy compound

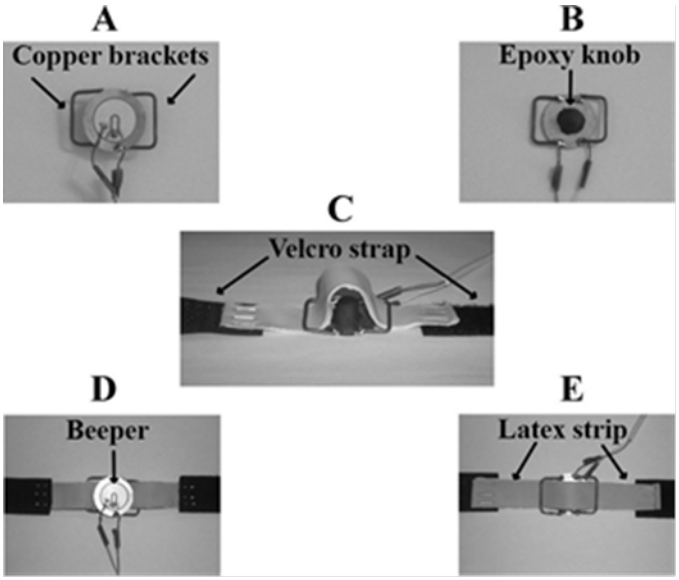

Fig 2 .Parts of the respiratory belt transducer.

A: piezoelectric beeper (front view).

B: piezoelectric beeper (back view).

C: respiratory belt transducer (side view).

D: respiratory belt transducer (front view

E: respiratory belt transducer (back view).

2.Arduino Duemilanove with ATmega 328

The Arduino Duemilanove ("2009") is a microcontroller board based on the ATmega168 (datasheet) or ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button[7]. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

V. SOFTWARE DESCRIPTION

1. LabVIEW:

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a system-design platform and development environment for a visual programming language from National Instruments.

The graphical language is named "G"; not to be confused with G-code. Originally released for the Apple Macintosh in 1986, LabVIEW is commonly

used for data acquisition, instrument control, and industrial automation on a variety of operating systems (OSs), including Microsoft Windows, various versions of Unix, Linux, and macOS. The latest version of LabVIEW is 2016, released in August 2016.

2. ARDUINO AND GENUINO UNO:

The Arduino Uno is programmed using the Arduino Software (IDE), an Integrated Development Environment common to all the boards and running both online and offline.

3. LabVIEW INTERFACE FOR ARDUINO TOOLKIT:

The LabVIEW Interface for Arduino (LIFA) Toolkit is a FREE download that allows developers to acquire data from the Arduino microcontroller and process it in the LabVIEW Graphical Programming environment.

VI . DESIGN AND WORKING OF RESPIRATORY BELT

The first step is to design a respiratory belt. The following materials are needed for the construction of the respiratory belt transducer:

- Beeper of a singing greeting card or buzzer (2.5 cm in diameter)
- Velcro strap (60 cm long and 2.5 cm wide)
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- Copper wire (1Ð2 mm thick)
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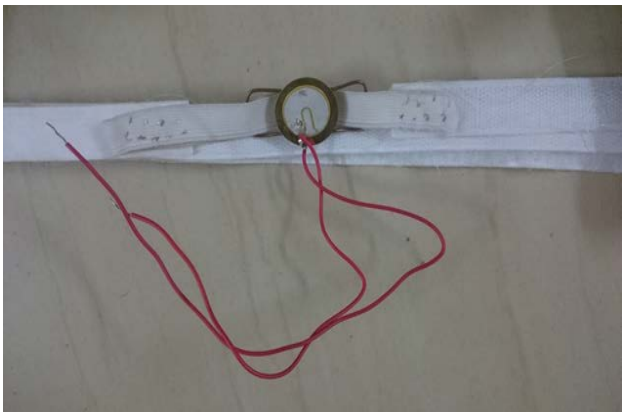
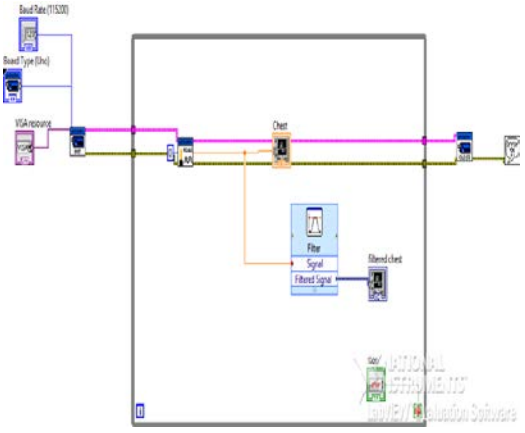


Fig 3.Respiratory belt

Now this respiratory belt is connected to chest and the signal is given to Arduino for further analysis.

Fig 4 .Respiratory Belt placed on the chest

VII. LabVIEW block diagram



SS 1. LabVIEW block diagram

PARTS OF LabVIEW BLOCK DIAGRAM:

1 INIT:

Initializes a connection to an Arduino running the LabVIEW Interface for Arduino sketch

2 ANALOG READ PIN:

Reads the analog voltage on the selected Arduino analog input pin (A0 - A5)

3 CLOSE:

Closes the active connection to an Arduino

4 SIMPLE ERROR HANDLER:

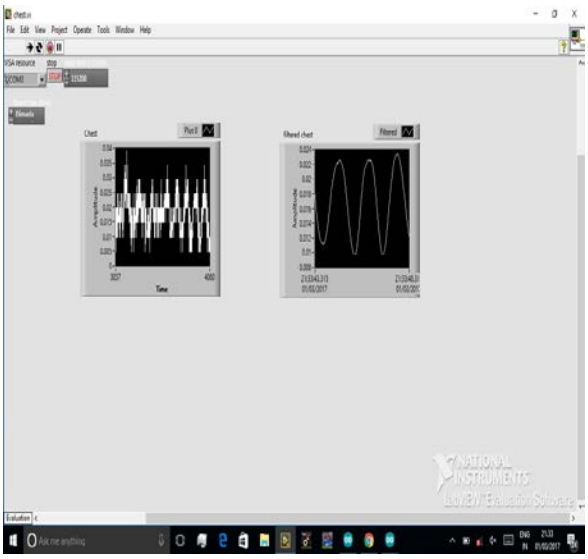
Indicates whether an error occurred. If an error occurred, this VI returns a description of the error and optionally displays a dialog box.

5 FILTER:

Filter is used to remove noise and give desired signal without noise.

VIII. RESULTS

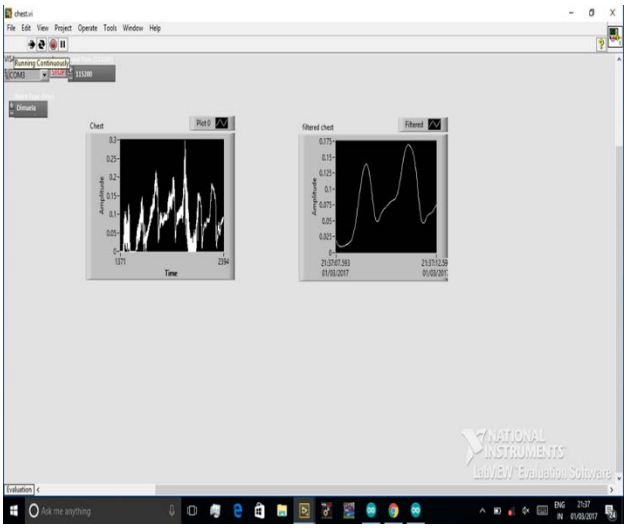
1 .LABVIEW OUTPUT DURING NORMAL BREATHING CONDITIONS:



SS 2.Normal condition

The voltage is obtained is 22 mV

2 .LABVIEW OUTPUT DURING STRESSED CONDITION:



SS 3.Stressed condition

The voltage obtained is 175 mV

Hence with the help of the value of voltages we can determine if the person is stressed or not.

For stressed condition the value of voltage is always greater than 150 mV.

IX .MULTIMETER OUTPUT

Subject 1 Age 21

Condition	Voltage (mv)
Normal	22
Stressed	175

Table 1.Multimeter Output1

Subject 2 Age 21

Condition	Voltage (mv)
Normal	45
Stressed	185

Table 2.Multimeter Output2

X .CONCLUSION

Thus this project aims at telling whether the person is stressed or not based on the breathing signals by using the assistance of Arduino and LabVIEW software modules. This is very helpful for the human beings and can thus take immediate measure if they find out that they are in stressed condition. This system is cost effective and therefore is affordable.

XI. REFERENCES

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