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PC Based Breath Monitor

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Abstract

A PC based Breath monitor has been designed and developed. It records the breathing profile of a person under examination. The software developed in C++ facilitates to create a data file and to plot the profile on the terminal. The monitor was used to record the breathing profiles of different persons and the results are presented.

1. Introduction:

Breathing is life. It is the vital source of energy. Unfortunately only a few breathe properly and completely. Those who breathe badly struggle with problems of health, profession and emotional life. A careful re-orientation of our breathing system can increase at least five folds our ability to use oxygen and eliminate carbon dioxide[1]. Even though the problem in breathing could be understood to some extent using a stethoscope, the analysis of a recorded breathing profile is bound to give more details. Respiratory rate is another important parameter of human health. It is one of the most reliable indications of autonomic balance[2]. John Allison[3] has designed a breath rate monitor using thermistors kept at 180°C as sensors. These sensors are kept hanging in front of the nostrils so that every breathe out cools the thermistors and the change is recorded as a pulse. In this paper the authors discuss the design and fabrication of a PC based breath monitor.

2. The instrument:

The monitor mainly consists of three parts; a sensor, hardware circuit to process the sensor output and an add-on card with interfacing software to interface the data with computer.

2.1 Sensor

The sensor designed by the authors is similar to the one suggested by Gerald Cybulski[4]. A rubber tube of internal diameter of 1mm and external diameter 3 mm and length and about 1000 mm was taken. It was completely filled with mercury taking care to remove all the trapped air inside. Both the ends of the tube were tightly closed and connections were taken out using copper wires.

2.2 Hardware

The complete block diagram of the breath monitor is shown in Figure 1. It mainly consists of a precision constant of a precision constant current source, a low pass filter, a high impedance buffer, a summing amplifier, a programmable gain amplifier and a 12 bit analog to digital converter which forms a part of the interfacing add-on card. The constant current source was configured using m A 741 operational amplifier to give a fixed output of 10 mA which a fed to the sensor. The sensor output is connected to the input of a high impedance buffer through a low pass filter. The buffer stage is introduced to do away the loading effects. The output of the buffer is fed to the programmable gain amplifier. The gain of the amplifier is automatically set by the I/O lines after sensing the output from the ADC.

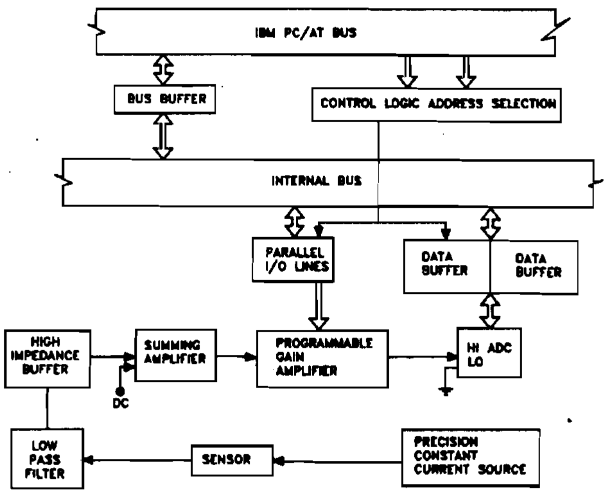

Fig. 1 : Block diagram of the PC based breath monitor.

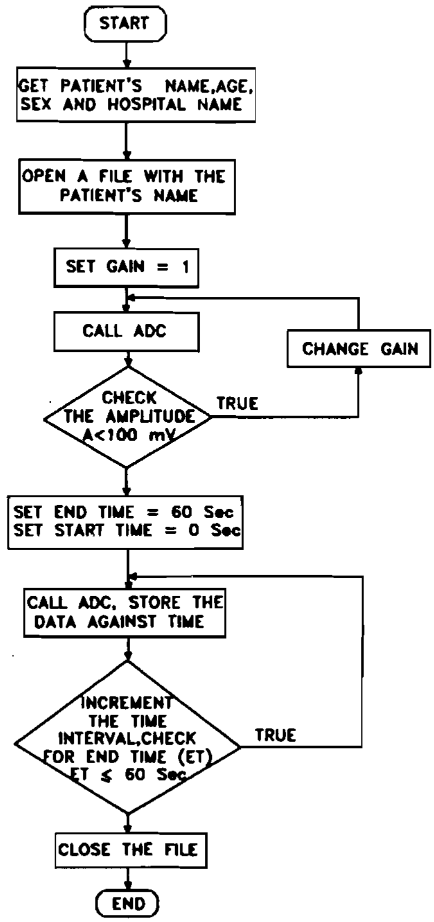

Fig. 2 : Flow chart of the software.

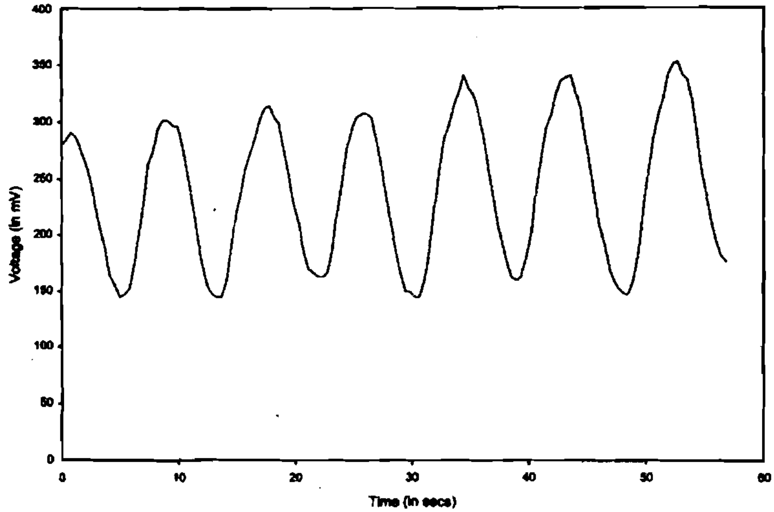

Fig. 3 : Breath profile of a normal person.

3. Software

A software package has been developed in C++ which facilitates to run the experiment on the patient. Figure 2 gives the flow chart of the software. Before the start of recording, the software prompts the operator to record the patients name, age, sex, name of the hospital and scanning time. The scanning time has been fixed between 15 and 60 seconds. During the experiment the software acquires the data and creates a file. The hard copy of the data can be had on a printer. There is a provision to plot the data on the terminal to view the profile directly. The hard copy of the plot can be obtained on a ink jet / laser printer using Microsoft Excel Software.

4. Results and discussions

The developed monitor was used to record the breathing profiles of different persons and the results are shown in figures 3 to 5. The person was asked to sit in a chair. The sensor was gently fastened to his chest and connections are taken out. After a minute of relaxation time the recording was started. In the plot, the X-axis represents time and the Y-axis voltage in mV. In our experiment the test time was fixed to 60 seconds. So the number of peaks along X-axis gives directly the breathing rate of the person per minute. In the y-axis the peak to peak height indicates relative breathing depth of the person under examination.

Figure 3 shows the breathing profile of a person of normal health recorded while relaxing. The breath rate is about 6/minute. The breath depth (in terms of mV) is about 150 mV. Figure 4 shows the profile of a meditator during meditation. The breath rate is only 4/minute and the depth is about 600 mV. Figure 5 shows the profile of an asthma patient. The breathing rate is about 21/minute and the depth is about 125 mV average. From the plot it is clear that the person takes more time for exhaling which is common problem with asthma patients. The abnormality is also seen towards the end of exhaling and at the start of inhaling.

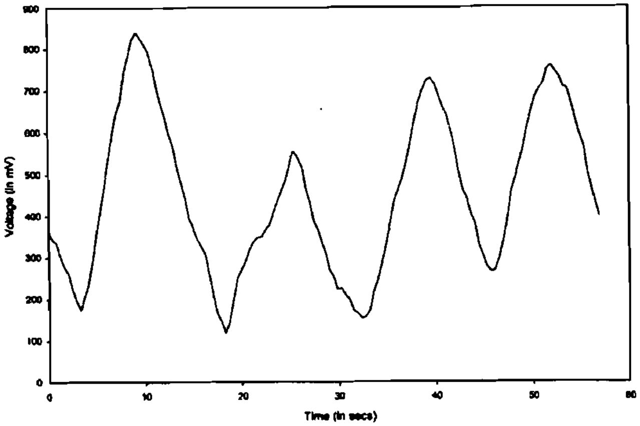

Fig. 4 : Breath profile of a meditator during meditation.

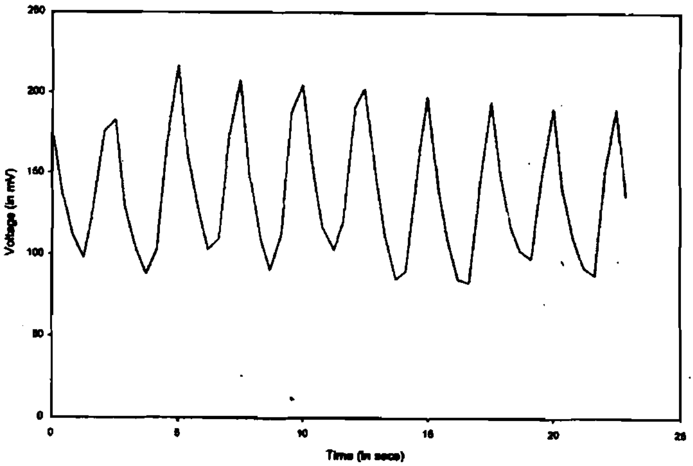

Fig. 5 : Breath profile of an asthma patnent.

5. Conclusion

The recorded profile shows that the developed instrument works well, reproducing the true breathing pattern. The authors feel that the instrument will find its application in the fields of medicine particularly to analyze the lung disorders. In addition the instrument will have its use in the fields of physical education and in schools of yoga and meditation.

References

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