

*LETTER TO THE EDITOR*

DATA ACQUISITION AND ANALYSIS USING CONVENTIONAL MULTIMEDIA COMPUTER: A COST EFFECT METHOD FOR COMPUTERISING ELECTROPHYSIOLOGICAL DATA

Sir,

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Sophisticated computers are now available for recording ECG, EMG, EEG and Evoked Potentials. We propose a cheaper alternative to such systems.

For signal amplification, a suitable amplifier with high common mode rejection ratio is required. Depending upon the nature of the signals the amplifier must pick up signals of low amplitude typically in the range of microvolts or millivolts. This can be procured at a fairly low cost from indigenous medical electronic companies. Another requirement is the Analogue-to-Digital (AD) Converters to digitise the signals. Data acquisition and storage software such as Labviews are very expensive. Custom programming is difficult as it involves software handshaking, interrupt handing and direct port addressing (1). Real-time data analysis is possible only when the above difficulties in custom programming can be overcome. Delayed data analysis can be done if the data storage format is known.

We suggest recording biological signals using a standard multimedia personal computer (PC) which is not very expensive. A prototype system is described below :

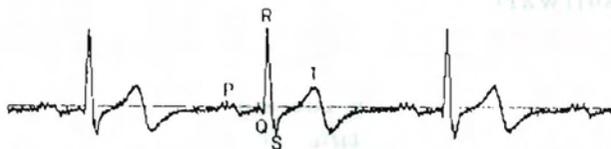
ECG was recorded from healthy volunteers through bipolar and augmented unipolar limb leads. The signals were amplified using POLYRITE (Recorders and

Medicare System, Chandigarh, India). Using a common mono-pin used for recording audio signals, the amplified signals were fed into the phone input jack of the sound card in a multimedia PC (Pentium 133, 64 MB RAM, 2.1 GB HDD, SVGA Monitor, PCI-VGA graphic card, 16 bit Creative Sound Blaster Card). The softwares used were Creative Wave Studio for data acquisition, storage and analysis: sampling frequency is 44100 Hz and sample size is 16 bits. (Copyright © Creative Technology Ltd. 1992-1995 version 3.16.1); Corel Capture for screen capturing (Copyright © Corel Corporation 1994 version 5.0); Paint for legend typing (Copyright © Microsoft Corporation 1981-1995). In the software, there are provisions for selecting the sampling rate and signal resolution. The software also includes the facility to calculate the time interval between two points in a wave form and expressed in milliseconds. Since the software is meant only for audio editing, there is no way of getting a permanent hard copy (print out) from it. Therefore, we displayed the waveform in the monitor and using a screen capture software (Even this screen capturing can be done using the inbuilt capacity of Windows' 95) captured the image and transferred it to a draw tool software like "paint" from which a hard copy can be obtained. Using "paint", we included the legends.

We used ECG instead of other types of signals like EEG or EMG for checking the system because the ECG waveform can be easily recognised. In the software, there is a provision to identify the time interval between two points of a waveform. Using this option, time duration of various portions of the ECG waves were measured. Initially, a calibrating signal of square waves of 1 millivolt generated by a oscilloscope was recorded. Eventhough the software does not have any facility to measure the amplitude of the waves, it is possible to know the amplitude in an indirect way, i.e. keeping the gain of the system constant, a known voltage can be initially recorded followed by the actual biological signal. By using a graph paper for printing, it is possible to detect the amplitude of the signal by comparing it with the calibrating voltage.

A sample of the ECG recorded through standard bipolar limb leads was shown in Fig. 1.

Our work shows that a sound card or sound blaster present in the multimedia



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#### REFERENCE

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computer can be effectively used as a alternative for the costly analogue-digital converter. Similarly, the software supplied by the sound card manufacturers (the necessary drivers and audio editing utilities) can be used to analyse the biological signals as well. From the observations it is clear that this method offers a fairly accurate values of biological signals (ECG in this case). These audio editing software also offer certain other attracting features like cut and paste utility which can be exploited for signal averaging. They also offer recording through two channels simultaneously. Thus this kind of setup may be used for SEP recording in which the stimulating pulse may be recorded in one channel and the evoked response may be recorded in the second channel. Coupled with the averaging facility, it may be used as a complete SEP setup. Other features of the software include the facility for increasing the amplitude for better viewing of the wave peaks in the case of very weak signals, compressing the recorded wave files to save the disk space and altering the sampling parameters.

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