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(54) Title: A DUAL MODE ECHOCARDIOGRAM

(57) Abstract: The invention relates to a dual mode echocardiogram monitor. It comprises both resting echocardiogram and monitoring echocardiogram. It consists of a dedicated single printed circuit board wherein the said printed circuit board consists of plurality of leads and having a modular upgrade option intended to connect this device to a central communication junction box with input from pulse oxymetre, NIBP monitor, temperature, respiration, invasive blood pressure, to receive resting echo cardiogram and monitoring echo cardiogram, the leads acquire bio-signais of patient and process the said signal and play at the pc connected to the equipment.

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# A DUAL MODE ECHOCARDIOGRAM

## FIELD OF INVENTION:

The present invention relates to the field of medical technology and more particularly relates to the Electro Cardiogram monitoring.

## BACKGROUND OF THE INVENTION:

An Electro Cardiogram Machine is used for recording the Electro Cardiogram signals of a patient during resting phase using a resting Electro Cardiogram and during activity phase using a stress Electro Cardiogram machine. These tests are conducted with specific time duration only. However, during emergencies when patients are admitted, they are monitored using an Electro Cardiogram Monitor which continuously monitors the Electro Cardiogram signals of the patient with alarms being provided to have timely medical intervention when the patient's physiological signs breach the limits set by the attending physicians.

In emergency cases the usual practice is to take a 12 lead Electro Cardiogram first for diagnosing the problem and then the patient is connected to cardiac monitor. And also it is necessary to take periodic resting Electro Cardiograms of the patients in addition to doing the monitoring of his Electro Cardiogram signals. Normally, 2 different equipment are used for this purpose – one for the resting Electro Cardiogram (a complete 12 lead Electro Cardiogram taken on a patient during resting phase for a specific time duration) and the other for Electro Cardiogram Monitoring (The Electro Cardiogram is displayed and read on a continuous basis and will capture the signals as the patient is connected to the machine). An integrated Resting Electro Cardiogram-cum-Electro

Cardiogram Monitor would be of great importance in "saving the time to treatment during critical moments" as both the applications will be available in the same system.

Inventor searched regarding novelty of invention using various databases including USPTO and found a document relevant to our invention namely United States Patent 6,440,067. On perusal of this specification it is found that our invention is different from the cited document.

SUMMARY OF THE INVENTION:

The present invention provides a unique 2-in-1 Resting Electro Cardiogram Machine and an Electro Cardiogram Monitor in the same medical device that allows switching between a Resting Electro Cardiogram machine and an Electro Cardiogram monitor by a software switch. The medical devices are connected to the computer in which the Resting Electro Cardiogram, Electro Cardiogram Monitor software operate in Windows environment.

Cardiac monitors produced in India do not have the in built case sheet that can be transmitted to a remote location for specialist review & opinion. The monitors do not have the capability of transmitting to a remote location using low bandwidth technology like plain telephone line.

But, it would also be highly desirable to have the electronic case sheet of the patient integrated with the Electro Cardiogram signals for display on the monitor for review by the attending doctor. There will be enormous value addition to the system if the Electro Cardiogram signals as well as the Electronic case sheet of the patient along with resting Electro Cardiogram could

be transmitted on-line in real-time using available low bandwidth telephone technology to a specialist doctor for further reference. This would give the advantage of remote monitoring of the patient condition for enabling appropriate treatment under the guidance of the specialist doctor anywhere anytime, especially whenever such specialist facility is not available locally. This gives the much-needed real-time telemedicine application for a country like India where majority of the population lives in the rural areas.

Dual use Electro Cardiogram with its transmitting capability is a type of real-time telemedicine application providing enormous benefits to society by bridging the gap between the availability of the medical service by competent medical personnel as well as the acute need for the medical service in rural and remote areas.

Appropriate treatment for emergency case patients will be available anywhere, anytime & can be affordable with the above invention.

OBJECTS OF THE INVENTION:

Accordingly, it is the object of the invention to provide an improved system of Electro Cardiogram monitoring.

It is an additional object of the invention to provide a unique 2-in-1 Resting Electro Cardiogram Machine and an Electro Cardiogram Monitor in the same medical device

DESCRIPTION OF THE FIGURES:

Figure 1 illustrates various modules of the device according to the invention.

Figure 2 shows the various steps involved in the end-to-end process concerned with the usage of the present equipment.

Figure 3 shows block diagram demonstrating the easy upgradability feature of the present invention.

DETAILED DESCRIPTION OF THE INVENTION:

Figure (1) illustrates the complete system of the present invention in which the Dual Use Electro Cardiogram device (1) is connected to the patient and in-turn connected to the computer which communicates with the communication network (2) to the remote monitoring station (3) for review and monitoring by the specialist Doctors.

The communication network (2) could be Plain Telephone line (POTS), ISDN line, Leased Line or World Wide Web for communicating with specialist doctor.

Figure (2) describes in detail the various steps involved in the end-to-end process concerned with the usage of the present invention from connection to the patient upto the review by the consulting doctor.

The patient at a remote end, which is the local end, is connected using the medical device (1) and the medical device starts acquiring the Electro Cardiogram data and sends to the computer using serial port or USB port (2). Usually, resting Electro Cardiogram is obtained followed by on-line Electro

Cardiogram for monitoring. The details for electronic case sheet, Emergency patient info (3) are entered in the system. The telemedicine software system takes over for transmitting the data (4). The data transmission is done using Plain Telephone line (POTS), ISDN, IP etc. (5). The Data is received on-line, real time at the monitoring end through the telecommunication medium (6).

The received data along with the clinical signs is reviewed by the Specialist Doctors at the monitoring end (7) and the specialist doctor conducts the review of the patient condition.

Figure (3) gives the Block diagram demonstrating the easy upgradability feature of the present invention, where-in Dual use Electro Cardiogram Device (1), SPO2 device (2) and NIBP Device (3) are connected to a medical device interface (4). These devices have the capability to either work independently or in any combination as needed by the user. These devices communicate with the Computer where the vital signs are monitored (6) and the electronic case sheet (5) along with the vital signs is transmitted using the telemedicine system (7) to the remote end (8) for monitoring by a specialist doc

The present invention provides methods of acquiring, transmitting, receiving, viewing, forwarding, reporting, storing and retrieving Electro Cardiogram Signals in on-line and real time mode as well as in resting mode for diagnostic and monitoring purposes utilizing the same device. These can be acquired and transmitted either in a stationery status or in a mobile status for further processing and follow-up action. The signals are acquired either on a Desktop computer, Laptop computer etc., and, they are either sent in their native form or compressed and transmitted to a stand-alone computer

The present invention provides a unique 2-in-1 Resting Electro Cardiogram Machine and an Electro Cardiogram Monitor in the same medical device that allows switching between a Resting Electro Cardiogram machine and an Electro Cardiogram monitor by a software switch. The medical devices are connected to the computer in which the Resting Electro Cardiogram, Electro Cardiogram Monitor software operates in Windows environment.

Normally Electro Cardiogram monitor has 1, 3 or 5 lead Electro Cardiogram display on the monitor. The present invention also provides for lead selectability of the chest leads and display of either 3, 5 or 12 leads in any other predetermined combination. The software also provides for selection of leads at the monitor end for display locally and transmission to remote end.

The present invention provides a unique 2-in-1 Resting Electro Cardiogram Machine and an Electro Cardiogram Monitor in the same medical device that comprises a dedicated single or multiple printed circuit boards.

Single or multiple circuit boards: the system can comprise of single or multiple circuit boards which can be the signal amplifiers, main boards etc., and also depending upon the other components that can be added on to the system, there could be a different printed circuit boards for the pulse oxymetry module, non-invasive blood pressure module, temperature module, respiration module, etc., all the necessary modules could be mounted on a single main board with different printed circuits for different modules can be made into a single printed circuit board also.

The present invention also provides for an Electronic case sheet to be filled-in giving all the relevant details that are present in a regular case sheet of a patient when he or she is admitted for treatment. This enables the treating

doctor to have a view of the acquiring Electro Cardiogram Signals as well as details of complaints, symptoms, signs, diagnostic test results, vital charts, treatment given & other relevant details.

The present invention also takes into account the "modular upgradability option" available with this device which can connect to a central communication junction box along with a Pulse Oxymeter, NIBP Monitor, to make a complete vital signs monitor in which individual modules can work either individually or together with the other modules.

The present invention also takes into account a telemedicine system that can connect the device through the computer for "transmitting the resting Electro Cardiogram, Electro Cardiogram signals" acquired from the patient to a remote end for surveillance and monitoring by specialist doctors. This specific software technology platform for transmitting biosignals using various forms of communication technologies has been earlier filed for patent registration under application no : 946/MAS/2002.

Central communication box: the role of the central communication box would be to independently acquire biosignals from various modules independently and together for further transmission.

The Electro Cardiogram Signals are sent either through a plain telephone line, GSM Mobile, GPRS Mobile, ISDN, Leased Line, VSAT and World Wide Web.

Using the technology platform provided in the present invention, Electro Cardiogram Signals are sent from one remote location to another remote location (or) from one to many (or) from many to one (or) many to many modes

for interpretation and follow-up action. Similarly resting Electro Cardiogram files are also sent using the same technology platform.

The technology platform is interactive in nature and provides for the remote interpreters to monitor the Electro Cardiogram signals either locally from a server or from a remote site themselves; transmit the same on to www and to discuss the same interactively with many interpreters.

The platform also provides for interpreter defined monitoring of Electro Cardiogram signals, provides for interactive text chat and Patient Medical records in the form of essential medical data to aid the interpreters in their analysis of Electro Cardiogram as well as follow-up action.

Similarly resting Electro Cardiogram files can also be acquired using the same device and transmitted to the monitoring end for the interpreters to view the same and give medical opinion on the same.

We have filed a co-pending application in respect of similar invention invented by us. The co-pending application relates to a system for real time online processing of biosignals using a telephone line. Whereas the instant application is related to a dual mode echocardiogram which will acquire biosignals through echo cardiograph. The co-pending application relates to the system for processing the biosignals and images acquired through the present invention.

Where the co-pending invention relates to a system to process the biosignals and images acquired by the dual mode echo cardiogram or any other apparatus. The instant application relates to the acquiring the biosignals through echocardiograph which are processed by the co-pending invention. Any other biosignals or images aquired by the apparatus are processed by the

co-pending application to receive at the central server which is situated at a remote end and an online real-time communication is generated between the two end using a telephone line.

Where the both the inventions are complementary and are in the same field of invention to facilitate the users to acquire the bio-signals by the present application and process them through the co-pending invention.

# CLAIMS

1. A dual mode echo cardiogram intended to process both resting echo cardiogram and monitoring echo cardiogram comprising a dedicated single printed circuit boards and having a modular upgrade option intended to connect this equipment to a central communication junction box with input from pulse oxymetre, NIBP monitor, temperature monitors, respiration monitors, invasive blood pressure (IBP), to receive bio-signals there by monitoring echo cardiogram, pulse oxymetre, NIBP monitor, temperature, respiration, invasive blood pressure (IBP), the said leads acquire bio-signals of patient and process the said signals and display at the pc connected to the equipment.

2. A dual mode echo cardiogram as claimed in claim 1, wherein it comprises a dedicated single or multiple printed circuit boards.

3. A dual mode echo cardiogram as claimed in claim 1, wherein there is option of modular upgradation intended to connect this equipment to central communication junction box.

4. A dual mode echo cardiogram as claimed in claim 1, wherein there si option to sxitch between the chest lead selectivity by a simple software switch.

5. A dual mode echo cardiogram as claimed in claim 1, wherein means for enabling switch over to monitoring mode through a software switch after acquiring resting echo cardiogram and vice-versa is being provided.

6. A dual mode echo cardiogram as claimed in claim 1, wherein the means for acquiring a resting 12 lead echo cardiogram as and when required for any time duration needed is being provided.

7. A dual mode echocardiogram as claimed in claim 1, wherein the means for enabling monitoring of 1-12 lead echocardiogram signals in real time, on line mode with optional lead selectivity is being provided.

8. A dual mode echo cardiogram as claimed in claim 1, wherein means for transmission of the 12 lead resting ECG taken while the monitoring is taking place is being provided.

9. A dual mode echo cardiogram as claimed in claim 1, wherein the means for enabling lead selectivity for echocardiogram signals at the acquiring and receiving end is being provided.

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN 2004/000126

A. CLASSIFICATION OF SUBJECT MATTER
IPC[7]: A61B 5/0402
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[7]: A61B 5/0402

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO 2001/006923 A1 (INSTRUMENTARIUM) 1 February 2001 (01.02.2001)<br>*the whole document.* | 1-9 |
| Y | WO 2001/091025 A1 (THIRDPHASE) 29 November 2001 (29.11.2001)<br>*the whole document.* | 1-9 |
| Y | DE 10102564 A1 (VITAPHONE) 1 August 2002 (01.08.2002)<br>*abstract, paragraphs 0019 to 0025.* | 6,7,9 |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/IN 2004/000126

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE A1 10102564 | 2002-08-01 | none | |
| WO A 2001006923 | | none | |
| WO A 2001091025 | | none | |