Development of Vital Recorder®, a Time-Synced Biosignal Data Acquisition Software

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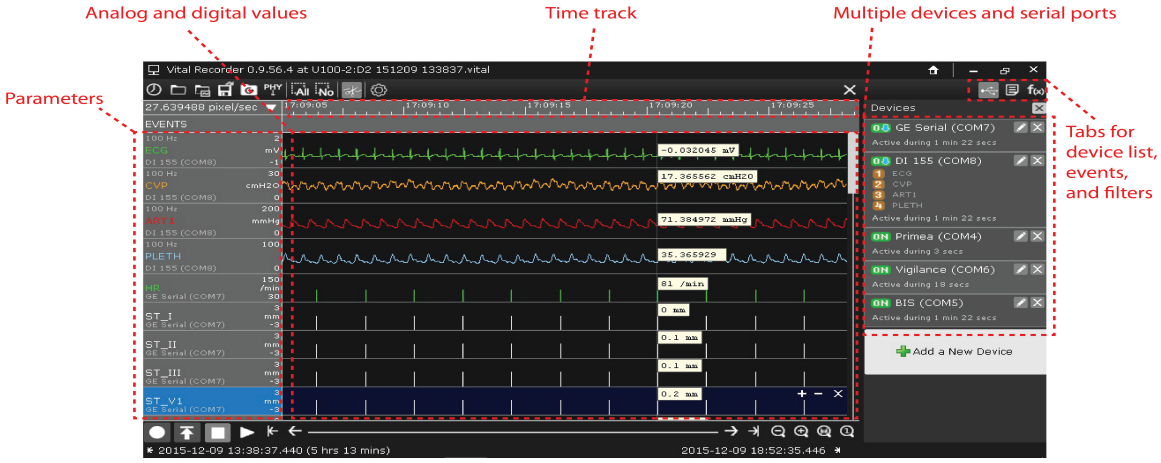
Background/Introduction: Currently, many anesthesiology investigators have lots of trouble in conducting researches regarding perioperative biosignal data because of high cost and complexity of commercial data acquisition systems. In addition, integrating data from patient monitor with those from additional medical devices such as bispectral index monitor, cardiac output monitor, anesthesia machine and infusion pumps requires more expensive and sophisticated hardware and software. In this study, we developed a low-cost medical data acquiring software that can obtain time-synced biosignal data from multiple medical devices, process the data in real-time and store raw or processed data.

Methods: The program (Vital Recorder®) written in C^{++} language runs on Windows® operating system. Hardware requirements are a low-performance computer, serial (either direct or cross type) cables and/or Arduino (http://arduino.cc) based analog-to-digital converter. Captured data are stored at local or cloud storage as a form of single data file that contains every data from multiple devices. The data can be processed in real-time with an open source script engine (Google V8, https://developers.google.com/v8/). By means of Vital Recorder®, we implemented a pilot study of data capturing and processing with algorithms in literature: calculating pulse pressure variation from arterial blood pressure wave and T-wave alternans from electrocardiography.

Results: Overall cost of the system was less than 100 dollars except the laptop computer. The system gathered time-synced data from 4 medical devices (GE Solar 8000M®,Covidien BIS vista®, Fresenius Kabi Base Primea®, Edward lifesciences Vigilance®) that were applied to a patient under general anesthesia. The acquired data were easily handled during data acquisition or after storing of the data. The wave data of arterial pressure captured at a frequency of 100 Hz were processed in real time and created pulse pressure variation track that parallels the moving arterial wave. T-wave alternans was successfully calculated using stored electrocardiography waves.

Conclusion: Vital Recorder® showed good performance with easy operability. Flexibility and low cost of the system was enhanced by the adoption of open source hardware and software. The software is going to be released for free to help investigators perform biosignal data researches. We also expect that stored biosignal big data can be used as a redundant source of evidence-based medical research.

Image


Analog and digital values
Time track
Multiple devices and serial ports
Parameters
Tabs for device list, events, and filters
Vital Recorder 0.9.56.4 at U100-2:D2 151209 133837.vital
27.639488 pixel/sec
EVENTS
ECG
CVP
ART1
PLETH
HR
ST_I
ST_II
ST_III
ST_V1
-0.032045 mV
17.365562 cmH2O
71.384972 mmHg
35.365929
81 /min
0 mm
0.1 mm
0.1 mm
0.2 mm
Devices
GE Serial (COM7)
DI 155 (COM8)
Primea (COM4)
Vigilance (COM6)
BIS (COM5)
Add a New Device
2015-12-09 13:38:37.440 (5 hrs 13 mins)
2015-12-09 18:52:35.446