Development of an application for real-time acquisition and synchronization of data from operative patient monitoring instruments

Authors

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Disclosures

K. Puthuveetil: None. **A. Venkatesan:** None, **R. Hang:** None, **D. Krusienski:** None

Abstract

Successful outcomes during surgery critically depend on a variety of instruments in the operating room for monitoring and regulating patients' vitals. It is common to employ trained clinicians or teams solely dedicated to specific monitoring modalities, such as cardiopulmonary perfusion, neuromonitoring, or anesthesia, for instance. The surgeon intimately relies on these clinicians to maintain patient vitals and to communicate any irregularities seen in their respective modalities. While an active dialog about the readings from the individual instruments is maintained between the clinicians and surgeon during the case, the signals are often not systematically synchronized or permanently recorded. Such synchronization and recording have several advantages beyond creating an archival record, such as using the data to better understand and model the impacts of the interventions during a case on the vitals and patient outcomes. The ultimate objective of this research is to not only synchronize monitoring but also to enable offline analysis for improved automated event detection. An application that supports recording from a multichannel analog-to-digital converter or via serial ports was developed. The application allows for a simple configuration of device communication parameters, enabling data collection from any medical devices with an analog or RS232 output, like those for transcranial doppler and perfusate flow/blood parameter monitoring modalities in our test case. The application also allows clinicians to make time-stamped annotations about events of interest, which can then be used to identify trends in signal characteristics during procedural abnormalities. The synchronized, annotated, multichannel data can be stored and used for later inspection or analysis. In our test case in partnership with VCU Health, the recording application will be used to track annotations and record signals from neuromonitoring instruments, among others, during cardiac surgery. The collected data will be used to evaluate the efficacy of the neuromonitoring system used by the hospital in improving patient outcomes.

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Objective:

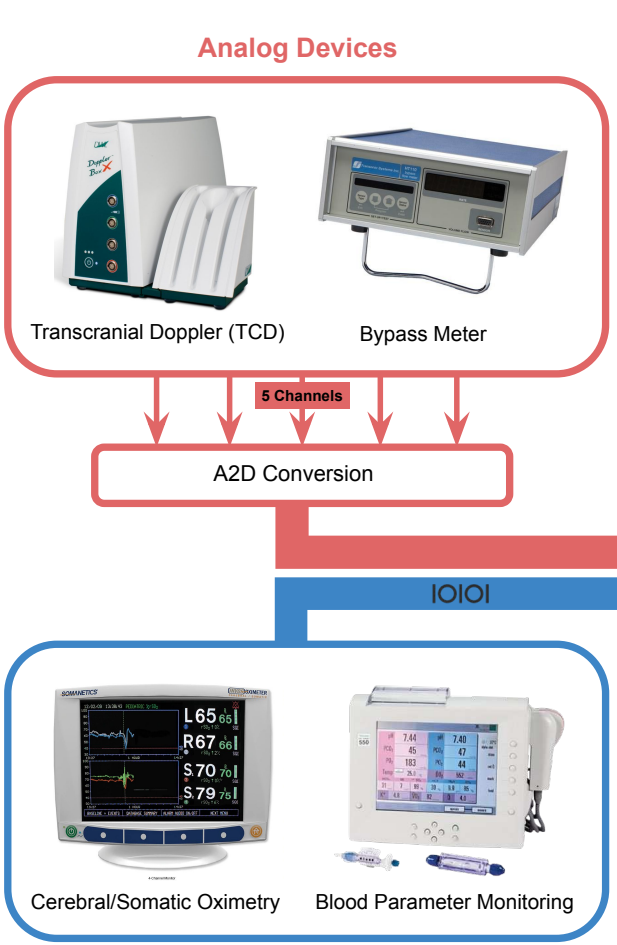
- Data from equipment and monitoring devices during pediatric cardiac surgeries at VCU Health is currently not systematically synchronized or permanently recorded. This data could be used to better understand and model the impacts of the interventions during a case on patient outcomes.
- This work aims to create an application that synchronizes monitoring and enables offline data analysis.

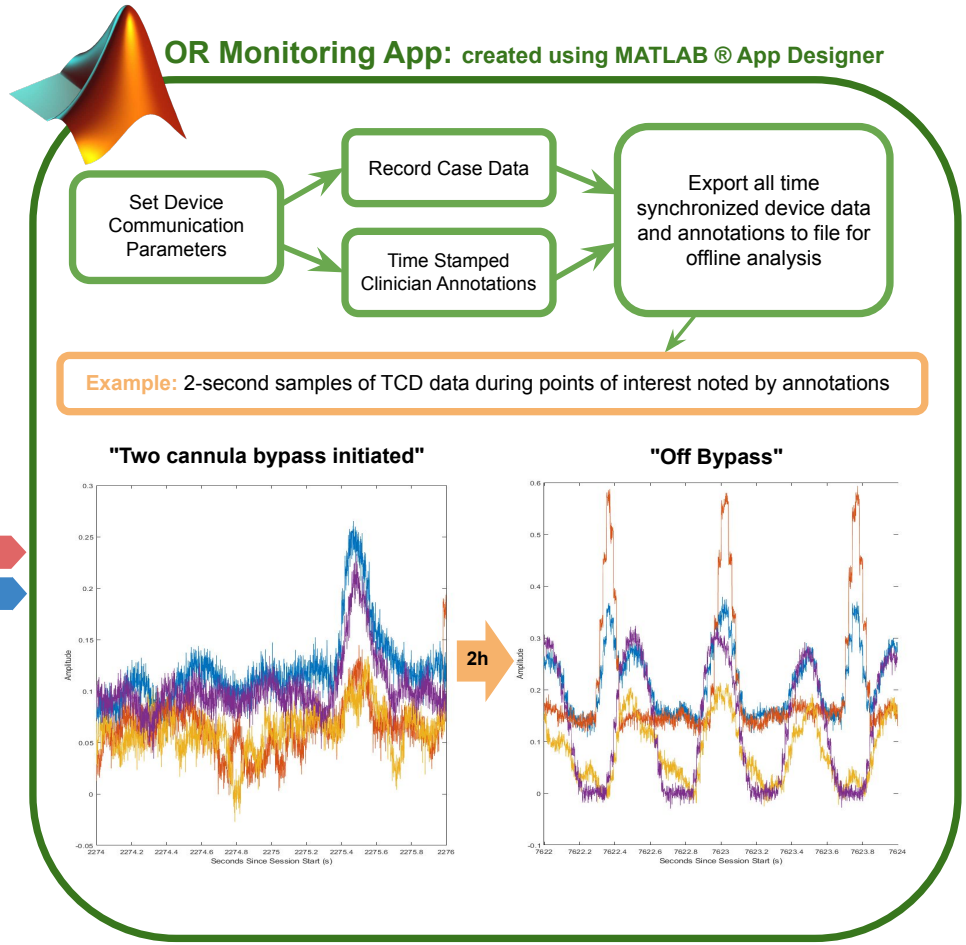
Application Functions:

- Configure device communication/data collection parameters in order to access device data streams
  - Analog signals via A2D converter
    - supports Data Translation DAQ devices (DT9834 used for present system)
    - adjust sampling rate, number of channels, terminal configuration, etc.
  - Serial devices with ASCII output
    - adjust terminator, baud rate, data/stop bits, flow control, etc.
- Create time stamped data annotations during a recording session
- Export all collected, time synchronous data and annotations to a file for further analysis

Future Work:

- Adding support for additional monitoring devices used by our partners at VCU Health
- Allowing device configuration to be saved to a parameter file to standardize recording sessions
- Enabling online data analysis, visualization, and event detection





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