

Creating an Innovative Medical Instrument Using NI Products



The ECMEG Biomedical Diagnostic System

"The product life cycle involves many phases before industrialization and deployment, but using a single platform to develop a prototype allows us to address any problems while significantly reducing time to market."

- F. D'Aniello, [Robotronix](#)

The Challenge:

Developing a diagnostic device capable of acquiring and processing biomedical data from three types of tests: electrocardiogram (ECG), electromyogram (EMG), and electroencephalogram (EEG).

The Solution:

Creating the ECMEG biomedical data acquisition and processing system, which is a compact, transportable, extremely precise, and reliable device, with NI products and standard sensor technology used in the medical field for conducting ECG, EMG, and EEG tests.

Author(s):

F. D'Aniello - [Robotronix](#)
M. Pagnanelli - [Robotronix](#)



Robotronix developed the ECMEG in conjunction with the University of Calabria to give the medical community access to a variety of extremely reliable and powerful data acquisition and processing platforms such as NI Single-Board RIO. Using the graphical programming characteristics of [NI LabVIEW software](#), we created a device capable of processing three different types of tests: ECG, EMB, and EEG.

Developing the ECMEG

We created the ECMEG biomedical diagnostic system for use with [NI reconfigurable I/O \(RIO\) technology](#). In creating this device, our goal was to provide an extremely versatile, easy-to-use tool that still satisfies the accuracy, safety, and reliability requirements specific to the biodiagnostic sector. With [NI Single-Board RIO](#), we markedly reduced the size and weight of the device as well as its energy consumption, which simplifies transportation and installation in any emergency vehicle while preserving its performance and reliability.

The sensors normally used for these tests are connected to the ECMEG device using the three frontal connectors (one for each test). We developed an interface to process the signals acquired by NI Single-Board RIO from the sensors placed on the patient. The software process saves and then provides external communications for the test results, which we can view on the external terminal monitor or using an LCD monitor located directly on the portable device.

The ECMEG has an Ethernet interface and can be connected to a LAN to transfer data to a storage device or a remote terminal (wired, Wi-Fi, WiMAX, or UMTS). Rather than requiring additional software to display the data when connecting to a remote terminal, we only needed the platform to have a Web browser with the installed LabVIEW applet, which can be downloaded for free from [ni.com](#).

To ensure portability and mobility, the ECMEG has an internal lithium battery and a recharging system that can interface with the plugs in emergency vehicles, allowing medical personnel to use the device in any location.

The software can display the data collected from the sensors after processing the information. We can also customize the analysis parameters to trigger automatic alarm signals when the established emergency thresholds are exceeded. We can set these thresholds for any characteristic of the individual signal, or for a numeric correlation among different signals.

In addition, we can enter the patient's personal details along with the test information, such as the date and location, and print the test results on the RS232 printer.

Using NI Tools

We completed the design, simulation, and manufacturing of the product with NI products. We conducted the entire process at the system engineering level and each step required the use of an appropriate NI tool.

We conducted the requirements verification phase, which is crucial in the medical field, using [NI Requirements Gateway](#). With this tool, designers and doctors can enter and modify requirements in familiar environments such as Microsoft Word and Excel, ensuring that the system engineer can manage specifications from different "sources" and supervise all of the requirements in one environment.

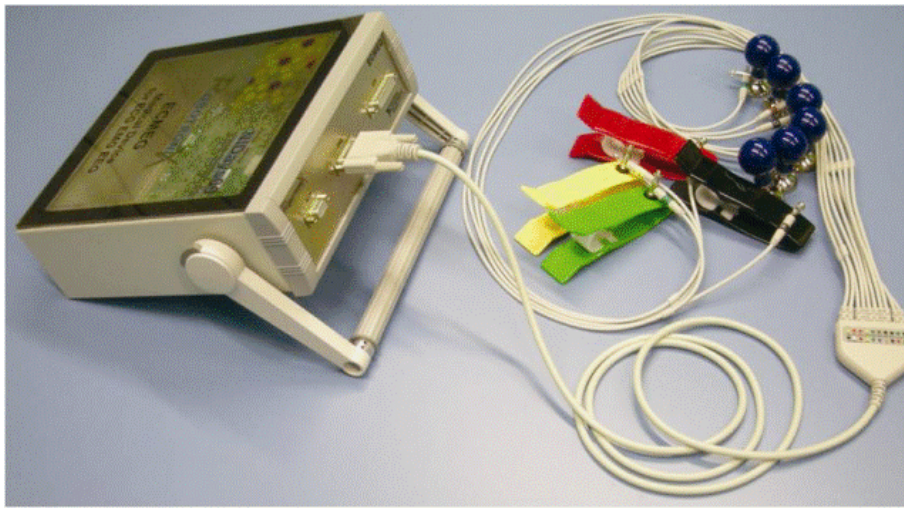
When designing the conditioning electronics, we simulated the circuit in [NI Multisim](#), delivering the typical signals acquired from ECG, EEG, and EMG tests through "virtual generators" created in LabVIEW and analyzing the response along the entire electronic chain. Using [NI Ultiboard](#), we designed the printed circuit board (PCB), which also made it possible to export a 3D model of the final circuit to use with SolidWorks to assess proper mounting of the circuit inside the device chassis.

Reducing Prototype Development Time

Using these tools, we simulated the system before manufacturing, thus eliminating the cost of modifying the finished system and reducing the total time needed to produce the prototype. The product life cycle involves many phases before industrialization and deployment, but using a single platform to develop a prototype allows us to address any problems while significantly reducing time to market.

Author Information:

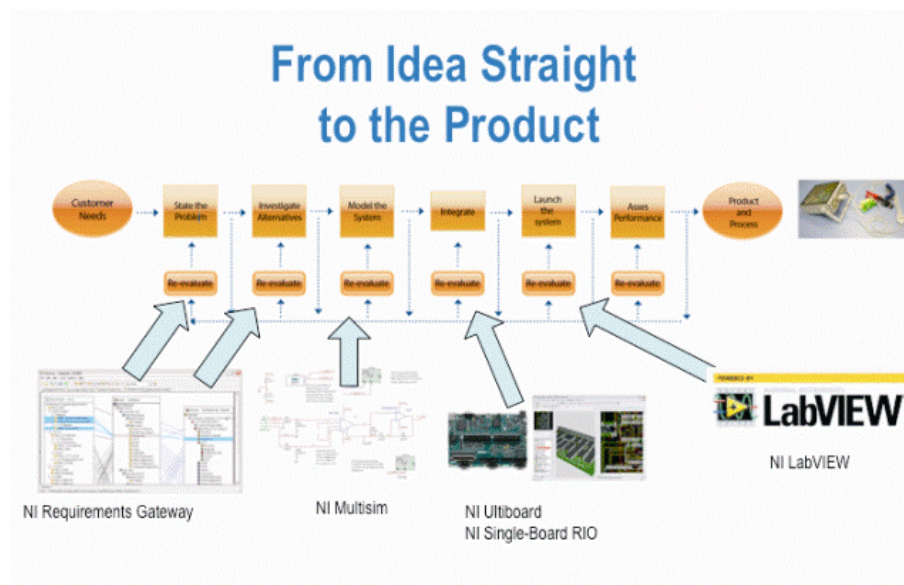
F. D'Aniello
[Robotronix](#)
fabio.daniello@robotronix.it



The ECMEG Biomedical Diagnostic System



We conducted the entire process at the system engineering level and each step required the use of an appropriate NI tool.



We used NI products to reduce development time and costs.

Legal

This case study (this "case study") was developed by a National Instruments ("NI") customer. THIS CASE STUDY IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND AND SUBJECT TO CERTAIN RESTRICTIONS AS MORE SPECIFICALLY SET FORTH IN NI.COM'S TERMS OF USE (<http://ni.com/legal/termsofuse/unitedstates/us/>).