Automotive Info Telematics
Product Functional Software Verification

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THE CHALLENGE
Creating a development tool to perform functional software verification on complex products with non-regressive test strategy.

THE SOLUTION
Developing automatic test equipment using PXI computer-based instrumentation with vision, motion, speech synthesizers, actuators, and special test sets, controlled by NI LabVIEW and NI TestStand environments.

THE TESTING PROCESS
In our R&D site in Venaria, Italy, engineers design and test Infotelematic Systems. For the hardware prototype verification, a specific test software developed with advanced design for testability techniques is used. Then, for the software verification, the application software is loaded and the functionality of the system in the car introducing specific user interactions is simulated. For both steps, a high performance automatic test system is used. When the application is loaded, the software size reaches more than 4MB; so, during development, if any modifications are introduced it is necessary to guarantee the functionality and reliability by the testing process.

THE PRODUCT
The Infotelematic System designed by Magneti Marelli could be considered as a system that gives the user a lot of comfort in terms of services and options like GSM, radio, voice recognition and speech, audio CD, GPS and navigation. An aspect that is relevant to the use of the Infotelematic System is the MMI (Man Machine Interface), where the user, by using the video and the keyboard, set the system for the different environments.

SOFTWARE VERIFICATION
The software verification is a part of the development process that is very important on a system this complex. With this level of hardware and software, a lot of functions are working at the same time (multi-tasking environment) and it is very difficult to simulate the operations performed by the car network and by the user. Our software robustness test assures that the product in output is more reliable.

For this reason Magneti Marelli decided to develop a system for the functional software verification.

TEST SYSTEM
The test equipment is based in two parts. The main PXI system, based on a PXI chassis with the on-board PC (NI PXI 8156B), the NI 8220 PCMCIA carrier where are inserted the CAN interface and the audio card for the speech synthesizer and the voice recognition, the NI 8330 (MXI-3) to control the NI 1411 (Image Acquisition) inserted in the PXI chassis used as slave PXI, the NI 6508 digital I/O used to control the internal matrix of the main PXI system, the NI 8420 (quad serial lines) used to control the instrumentation on the main PXI, the NI 6070E multifunction I/O used to generate or acquire digital signals.

The other instrumentation used is the GSM Network Simulator, the radio broadcasting synthesizer simulator, the RDS encoder for the RDS generation. For the GPS system, we used a dedicated antenna and for the power supply. The application under test uses a power supply 60V - 50A. The GSM and radio antenna input could also be switched to an external antenna. The slave PXI is more related to the actuation for the MMI verification and consists of an automatic mechanical actuator, with all the relative controls, trough a PLC managed by a PC serial line, for the keys precision, two step-motor for the encoder rotation, a color camera for the verification of the display, and two parts for the automatic insertion/deassertion of the CD and the SIM card of the telephone. The speakers on the output of the radio are simulated but anyway it is possible to connect real speakers for debug purposes.

In the debug environment an interface is available where it is possible to send commands directly to each part of the mechanical interface and to the camera where it is possible to acquire or check an image in real time. For the software management Windows NT has been used with National Instruments TestStand and LabVIEW to manage the testing and simulation sequences.

With this software structure it is possible to run sequences where there are simulated users operations, emulating the communication between the Infotelematic System and the car trough the CAN interface, and in the same time simulating user operations during parallel processing of the system (radio and RDS generation together a GSM communication, GPS reception and MMI management, CD-player, data management).

The software structure of the test system has been developed and validated by the testing team so that the development and maintenance time is reduced and the sequences used for the software verification could be easily created.

RESULTS
We are planning to increment the software verification activity in order to deliver reliable application software to our customers with NI hardware and software products like LabVIEW Real-Time and the 14-slot PXI.

Products Used
LabVIEW™, TestStand™, PXI, serial, CAN, MXI™-3
DAQ