Instead of speaking about what **Borneo** (our programmable embedded display module) is able to do, we will speak about what **Borneo** is already doing. Thru several articles, we will see different applications which show the Borneo system capacities.

Borneo is a flexible hardware/software solution based on **FPGA** and **Java** technology to create easily customized embedded systems. The system will be customized in order to fit the application requirements: low power, Embedded HMI, low cost, signal processing, etc.

For more Information about Borneo system:

http://www.a-e-d.com/borneo.html

http://www.a-e-d.com/PDF/AED_BorneoPla.pdf

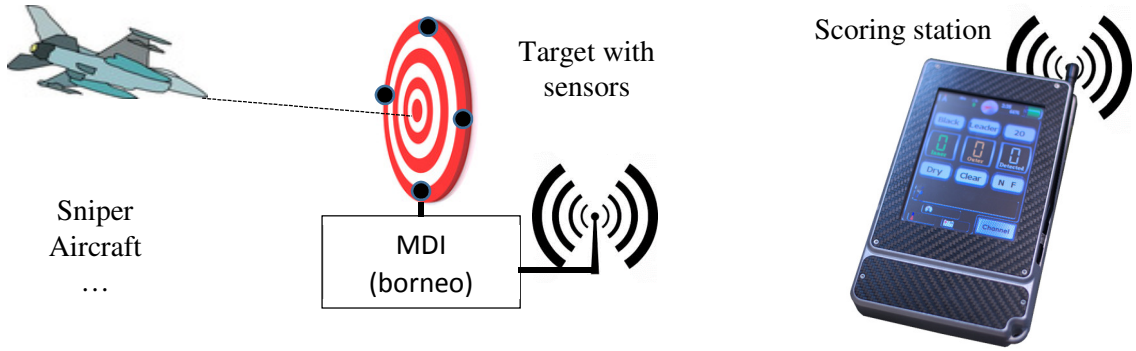
http://www.a-e-d.com/PDF/AED_ProduitBorneoPla.pdf

http://www.a-e-d.com/PDF/AED_Borneo.pdf

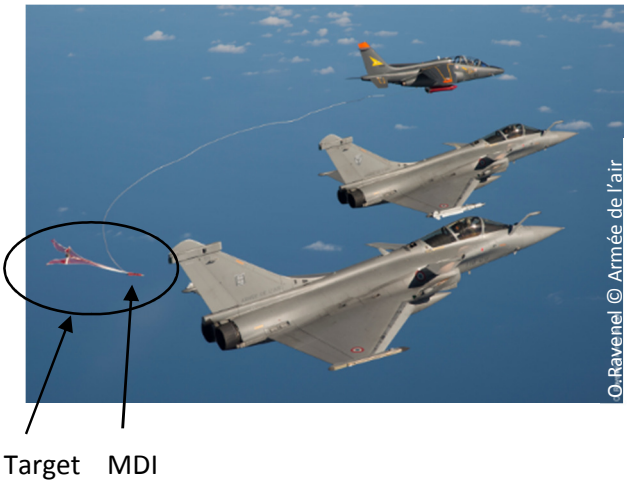
Borneo and Digital Signal Processing

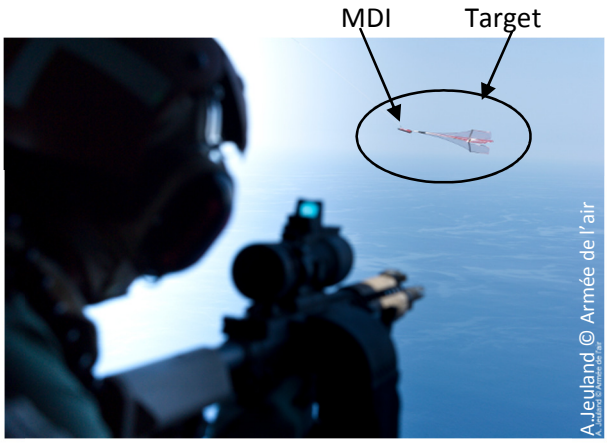
In this article, we will see a military application which mainly use the **digital signal processing** capacities of **Borneo**. This application has been developed for a shot scoring system.

Overview



This application is called **Miss Detection Indicator** (MDI). The MDI System equipment is integrated into the aerial or ground target, and automatically detects and measures the passage of supersonic projectiles. This information is then transmitted in real-time by radio link to the Scoring Station. The training results are shown in real time on the scoring station.





Hardware

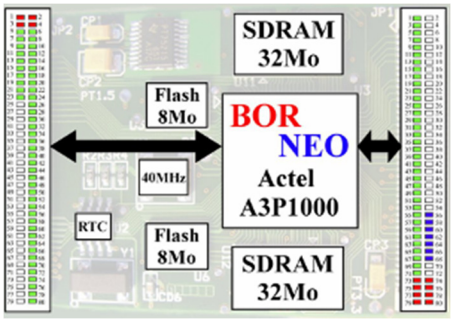
In this case, the **Borneo** system has been integrated in a generic daughter board called **ARKEON64** (64 means 6cm by 4cm). ARKEON includes all components needed by the Borneo system:

- FPGA MicroSemi A3P1000 (256 pins) : used to run hardware IPs

- RAM to run programs

- Flash Memory to store nonvolatile data (Operating System, application, user data).

- 2 connectors which connect around 80 pins of the FPGA to the mother board.

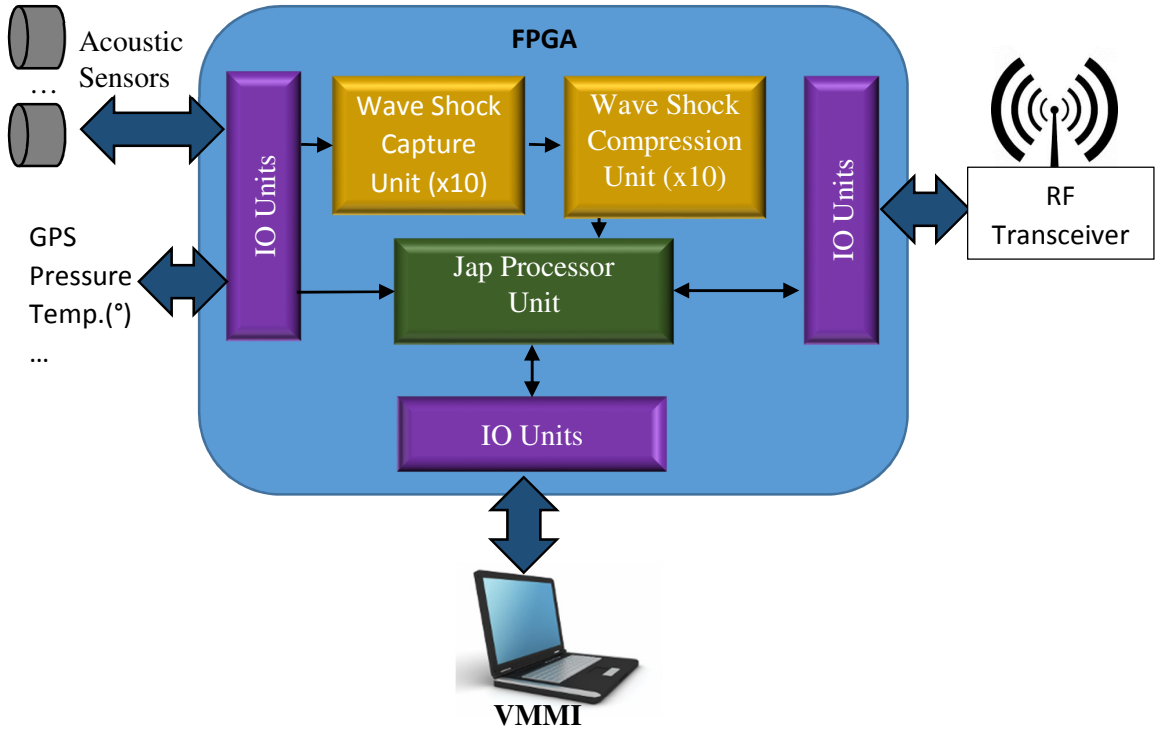


For more information about Arkeon64:

http://www.a-e-d.com/PDF/AED_Arkeon_pla.pdf

http://www.a-e-d.com/PDF/AED_Arkeon.pdf

FPGA IPs



IO units:

All peripherals and sensors are connected to the system core thru IO Units. This application uses the IO units to connect more than 10 SPI buses, 1 OneWire, 3 UARTs, 1 I2C and some Global Purpose IOs.

WaveShock Capture Unit:

This MDI version is able to process ten Acoustic Sensors. Each Acoustic Sensor is connected to a Wave Shock capture unit. The Acoustic Shock emitted by the projectile speed is captured. All shock waves can be sampled at a frequency of 1 MHz. The WaveShock capture units are parameterized to filter noise and trig only when an acoustic shock occurs.

WaveShock Compression unit:

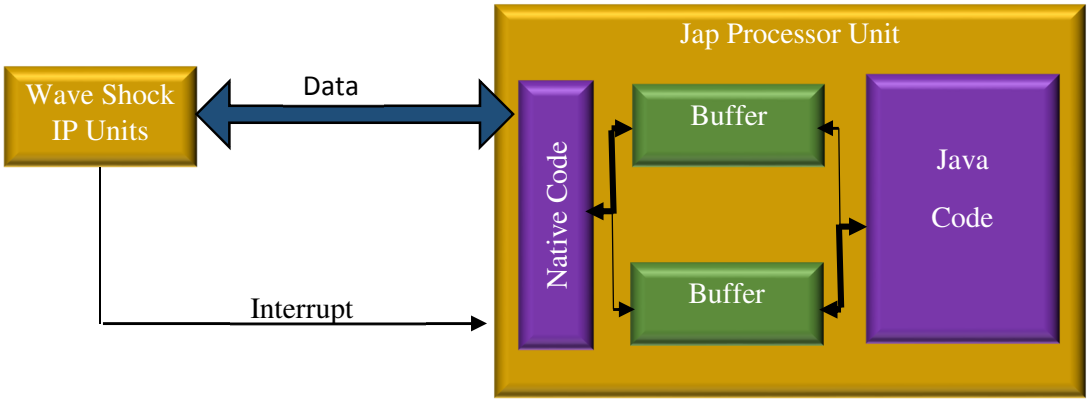
The sampled wave shock is just in time compressed by the compression unit. There is one compression unit by capture unit. The wave shock is compressed in order to be transmitted and analyzed by the scoring station very quickly.

JAP Processor Unit:

The **JAP processor** executes the Application program. This program encapsulates compressed wave shocks in secured frames. The frames are next sent to the RF transceiver. The program is written in Java. Java language is especially well suited for this kind of application. When a training is started, it can involve a lot of heavy equipment, personals and money (for example aircraft or navy trainings).

The Java Exception mechanisms provide high execution security and debug reports. Even in case of important problem (peripheral malfunction for example) the system must try to be as functional as possible. In case of unsolvable exception the system reboots.

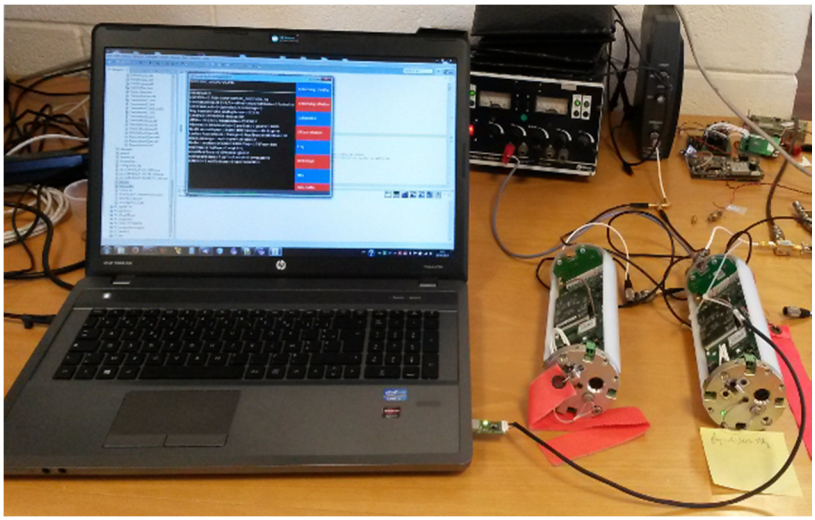
The Java code and the IP units transfer data thru buffers and registers. The Java code configure IP units with registers and IP units are driven by natives (C or assembly code) which read the units and fill the buffers. The Java code scans the buffers periodically and process them asynchronously. There are at least two buffers: One is processed by the java code and the other one is filled by the IP units. The java code is preemptive and when a shock wave is detected, an interrupt is sent and the native code is launched. When the native code has retrieved all data from sensors, the java code continue its execution.



For more information about processor JAP:

http://www.a-e-d.com/PDF/AED_Jap_ip_pla.pdf

MDI is a complex system with a lot of parameters. The MDI is enclosed in a metallic box for robustness and security reasons (vibrations, shocks, etc.) without any buttons or display. Thus, to configure and control the MDI, the program also manages the **Virtual Man Machine Interface** (VMMI). The Borneo System integrates this function in order to provide a Graphic User Interface even if no physical display is connected to the system. In this case the GUI is sent on USB port. The GUI is displayed on a remote device (such as a PC). The Borneo program acts as if a display was connected on the system and doesn't care about the nature of the physical display.



For more information about VMMI:

http://www.a-e-d.com/PDF/AED_IHMV.pdf

http://www.a-e-d.com/PDF/Electronique-Septembre-2010-n8.pdf