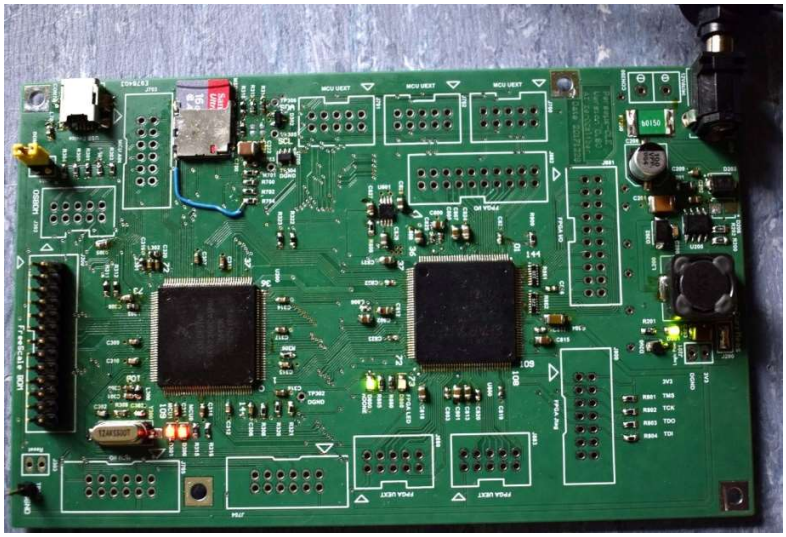
PerseusCLE - Coldfire Light Edition



Features

1. Wide range DC 9-36V ac/dc supply voltage
2. MCF52258 Coldfire @48MHz, 512KB Flash, 64KB RAM
3. Spartan XC6S-9LT FPGA @48MHz
4. 24MB/sec Link between MCU-FPGA, memory mapped
5. RTOS based design framework
6. Olimex UEXT Connectors for external modules

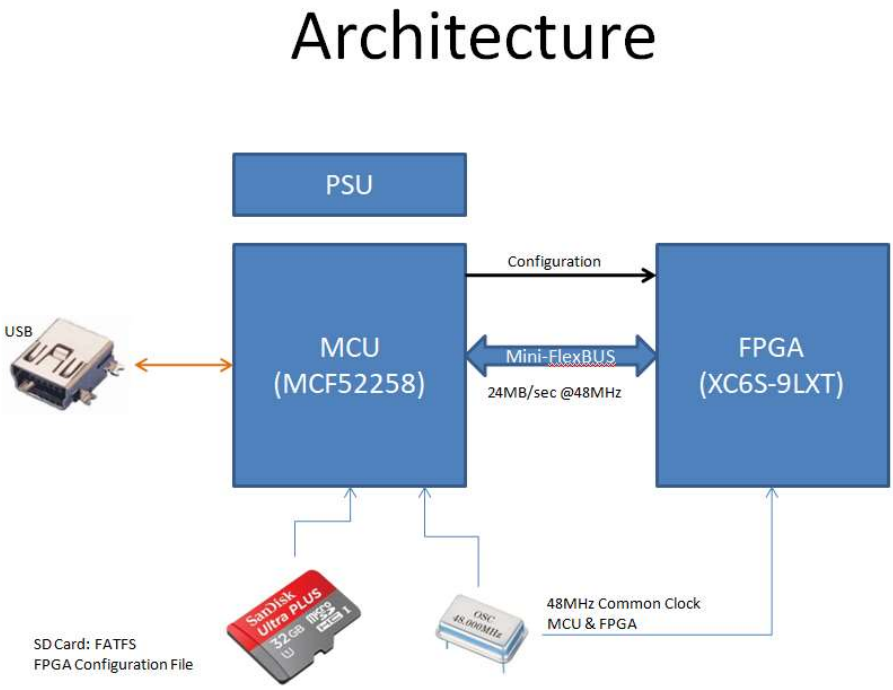
Description

Microcontrollers offer a small footprint system with high level of integration (memories, peripherals etc), but sometimes the internal peripherals or the processing capacity are not adequate to tackle with more demanding applications. FPGA on the other side are more flexible and capable but usually they are not the best for control flows and require more knowledge for development. In order to combine the benefits of both worlds the PerseusCLE was built.

This is a simple universal design that integrates a microcontroller and an FPGA in order to perform hardware acceleration, functional and I/O expansion, or design verification of an embedded system, using a minimum amount of chips.

The two major parts are interlinked with a high speed connection to enable FPGA mapping inside the microcontroller's memory space, giving programming

simplicity for the firmware, while achieving high speed transfers, and allows use of the internal MCU DMA. Eventually this provides a two chip solution and simple two layers PCB which allows low cost on low production quantities.



To support the potential uses of the hardware a firmware stack is also provided, that enables programming the FPGA configuration from the SD card, and provides the access methods to the FPGA side along with drivers for Serial, USB, SD, FATFS etc. The stack is based on a modified version of FunkOS RTOS, and the extensions provided are developed using TDD to ensure high quality and reliability of the system.

The FPGA VHDL code flow for simulation uses UVVM and OSVVM to support a solid verification strategy.

Along with the hardware, we provide source code with examples for the microcontroller, and example VHDL interface.

Applications

This platform can be used very effectively for the following applications.

Drones/UAV

As the hardware is flexible, controlling multiple motors and acquiring sensor data from multiple sensors, make this platform ideal. The MCU can be off-loaded from low-level motor driving, while concentrating on the main control system. The FPGA can handle the low level functions along with the sensor fusion for multiple sources (ie. camera).

3D Printers

Having a platform that can handle more motors can create a more capable 3D printer or even a 3D printer in combination with a lathe. Again the high level functions can run on the controller while the FPGA keeps track of the precision in time.

Small Video Applications

The video signals stopped to be analog and transformed to high-speed interfaces. The Spartan 6 series can handle these and create video input or output generators (or a combination there-off) while the microcontroller can handle the content (ie. transfer it through the USB). No more complex CPU high frequency arrangements are required.

Beamforming

As the FPGA can offer a high degree of parallelization, applications that require a high number of parallel units are good candidates for this platform. For example controlling an array of ultrasonic sensing elements we can create a system to electronically scan in 2D or 3D the surrounding area.

Software Defined Radio

As the speed of the digital logic is highly increased during the last years, it is possible to use a high speed ADC interconnected with a serial link to the FPGA to acquire a wide bandwidth signal and decode the required signal from anywhere inside this band. This architecture keeps the RF components to minimum as there is no need to precisely tune the circuits at specific frequencies and gives the flexibility to change frequencies or modulation schemes by software.

Embedded System Controller

Controlling a divert number of actuators and sensors hasn't be easier. Controlling Stepper motors, LED arrays, BLDC or gathering sensor data from different sources can be done easily. The FPGA can include the low level logic of control and pre-processing while the MCU handles the control and connectivity side of the application.

Embedded Design Verification

For many applications the FPGA is overkill device to have. However you may be able to test the real-time embedded firmware, without any performance impact if you use the FPGA for capturing processor data. For example stack checking in hardware is very efficient and accurate. So you can use the combined system to trace events, check stacks, and any other aspects of your embedded system before you deploy it and gain more confidence of the quality of your product.