by Vinay Sharma

Electronic System ….."A processing platform, where all element work together for a goal, with the given set of instructions."

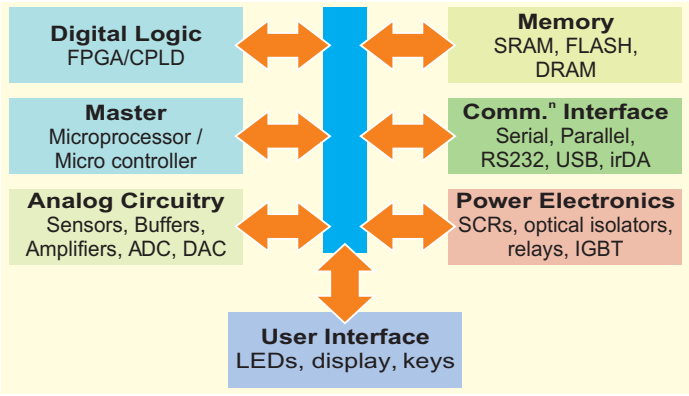
To learn this statement an engineer goes through a rigorous 4 years of engineering course to start realizing it. The life of electronics engineer revolves around developing next generation systems which will lead the market and help mankind to ease work.

Before making an idea into final product, it has to be prototyped and tested in labs before it goes into production line. A prototype is fully functional model of the original idea generally made up with available test boards to check & test the functioning of the original system.

But learning to prototype a system is a Herculean task, as designing a system comprising of many elements working on different technologies, protocols, voltages, timings etc have to be taken care before one starts to pen down the final sketch.

Many of times, engineers do not find suitable prototyping board for their applications, which force them to buy new test board for every new application. The availability of universal board for universal applications is hard to find.

But what we mean by universal platform? To define it, first we have to define an electronics system in blocks.
The figure 1 depicts an electronic system comprising of various blocks:



Any electronics system can be build around with 7 technological blocks provided. Every system revolves around these blocks only, whatever changes are to be made depend on the application requirements.

Overview of System Blocks

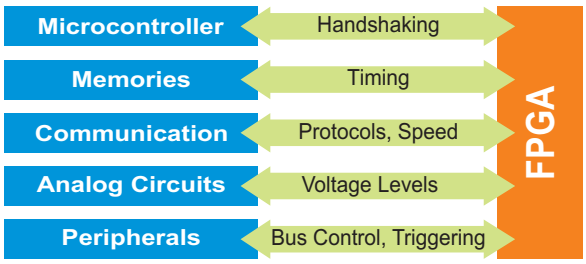
Microprocessor/Microcontroller

These are brain of the system; which controls every activity on board. Most commonly used controllers are 8051, PIC, ARM & AVR series of controllers, due to their availability cost and stability. Microcontrollers are really good managers, with lots of ports, timers, & are In-System-Programmable which makes them highly flexible.

Digital Logic (FPGA, CPLD)

With the advent of FPGA & CPLD, most of the designers have migrated to these. FPGAs provide integration of huge complex circuits into one. With features like flexibility, in built RAM, small form factor & higher operating frequency, FPGAs are one chip solution for many digital applications. But a starter has to learn many concepts while learning designing with FPGA apart from learning only HDLs. As FPGAs are sensitive to asynchronous designs, engineers have to handle it with synchronous clocks only.

Apart from this interfacing FPGA with other system components is a smart job. For instance, interfacing with microcontrollers, FPGAs have to take care of handshaking; interfacing RAM you have take care of timings; interrupts & done signals have to taken into consideration for ADCs, etc. Refer figure 2 for FPGA interfacing with blocks.



Communication Interface

Every system has to be interfaced with others for transfer of information or data. The communication interface is based on many parameters, like data size, speed, operating cost, ruggedness, environment, etc. There are various protocols which are standards now and most commonly used. For eg. RS-232, RS-485, USB, parallel port, irDA, PCI, etc. Most of the microcontrollers have inbuilt communication protocols handlers like UART, USB/PCI bridge, etc, but for FPGA an engineer has to write his own controller to make use of these protocols in real world.

Memory
Many applications require information to be stored in the external memory which can be in the form of RAM, DRAM, FLASH, etc. These memories also work on the simple read/write protocols. For eg. accessing a asynchronous RAM is simple unless access times of memory are taken care of.

Analog Circuitry
Every system finally process external world signal which is analog in nature; and which has to be conditioned, digitized & then processed for the said application. Microcontrollers and FPGA can be directly interfaced with ADC & DACs, but for high voltage & current handling engineers use IGBT, SCR, TRIAC etc.

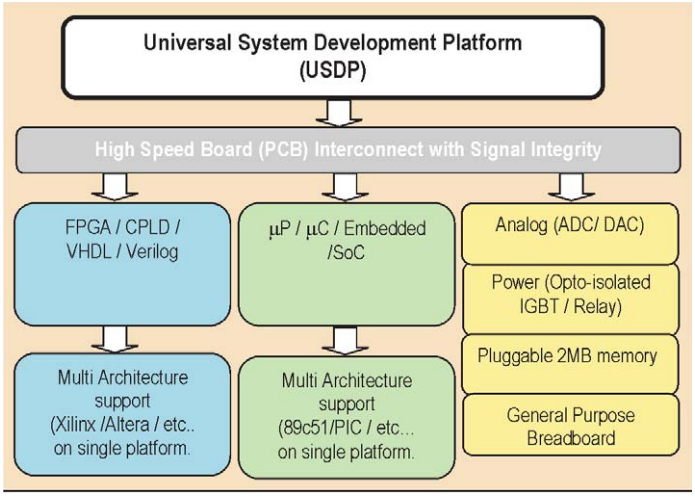
Power Electronics
For power electronics & electrical applications a microcontroller or FPGA has to take help of IGBT, SCR, TRIAC or relay to control the outputs. For example to control a 12VDC motor, a FPGA can control through PWM o/p but this o/p cannot drive directly the motor, for which he has to drive through IGBT. A design engineer should be very careful to use high voltage devices with sensitive FPGAs, like optical isolation, as otherwise any back current can damage the FPGA.

Many systems can be build around these basic blocks and selection of devices & interfaces would depend on
- Θ Application
- Θ Handling
- Θ Environment
- Θ Cost
- Θ End user needs

Overview of Universal System Development Platform (USDP)

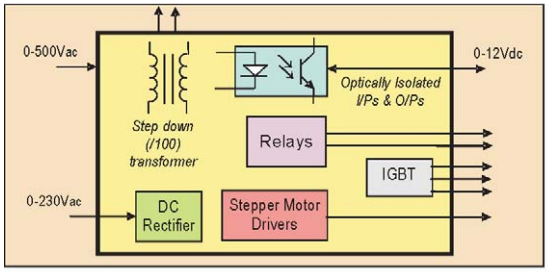
Universal System Development Platform (USDP) is prototyping solution for every kind of idea development. It contains a baseboard with many edge connectors to hookup various modules for each technology. It supports interface of FPGA, Microcontrollers, memory, power electronics blocks, ADC/DAC, displays, keypad, etc. all on same platform.

USDP can be used for satisfying the varying needs of both a beginner as well as a professional, with its host of advanced features along with easy operation, allowing the developer / student to concentrate on real task of developing / learning the design issues instead of wasting time in learning the tool operations. Thus achieving the efficient use of his time, skills along with researching and developing better Design / Engineering practices.



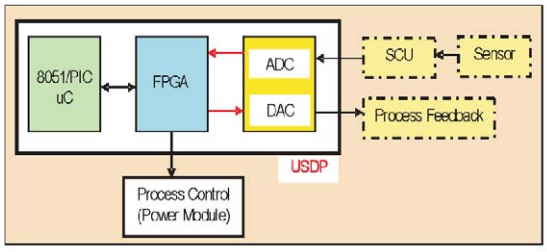
Highlighted features of USDP
- Θ Slot cards for FPGA from Altera, Xilinx and other vendors.
- Θ Stacking of multiple FPGAs (can be of different vendors).
- Θ High performance backplane.
- Θ 32 Digital I/Ps and O/Ps, each can be configured as input or output giving flexibility to designers.
- Θ Four seven segment Multiplexed display.
- Θ 4x4 switch matrix keyboard interface.
- Θ On board crystal oscillator socket.
- Θ Parallel port interface.
- Θ Stacking of maximum three Add-on card modules possible of different technologies.
- Θ 89c51 Microcontroller card for traditional 8051 applications with ISP support.
- Θ PIC 16F877 Microcontroller card for industrial based applications.
- Θ Memory Card for data intensive applications.
- Θ High performance ADC/DAC add-on card.
- Θ Power module for motion control and electro-mechanical applications.
- Θ and many more...

Power Module
Externally interfaced power electronics module provides lots of interfaces for power electronics applications. With 5 optically isolated o/ps, users can drive high voltage circuits with proper isolation. It also has 2 optically isolated inputs.
Apart from these a step down transformer, 2 optically isolated relays, stepper motor driver, IGBT, DC rectifier give various choices for designers to develop many applications.



USDP Applications
Some examples have been provided for understanding the use of USDP as a platform for System / board level development where reliable interface of multiple modules is required for development of the complete system.

Temperature Controller
Generally for temperature controller system, inputs are temperature signal in form of voltage and set-points; outputs are processed PID, control for relays and user interface.

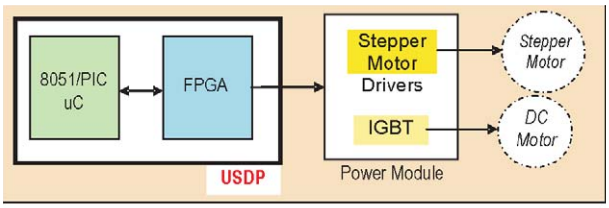


USDP for temperature control applications

USDP is ideal for temperature control applications. Only a temperature sensor has to be interfaced along with its signal conditioning unit (SCU) to ADC. After the digitization of temperature values, user can manipulate the values and control the process using FPGA or the microcontroller cards.

Motion Control

Stepper motors & DC motors are widely used and plays a vital role in robotics environment for implementing arms, handles, moving/rotating mechanisms. With the use of external power module USDP can prove good platform for motion control applications. With power module the motor interface can be done easily, motor processing and control at high speeds can be done by FPGA, data communication with computer can be done via RS232



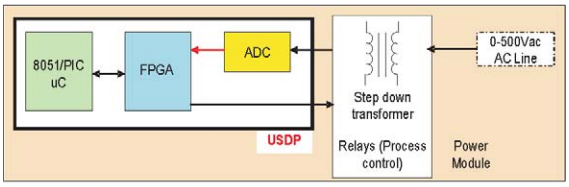
USDP for motion control applications

on Micro controller, in this way a whole system can be assembled on USDP.

AC line Monitoring

In many of the electrical applications AC line are to be monitored for fluctuation in voltage or frequency. But the high voltage of 230 Vac is difficult to interface with ADC.

To solve this problem USDP's power module has onboard divide by 100 step down transformer. With which engineer can easily scale

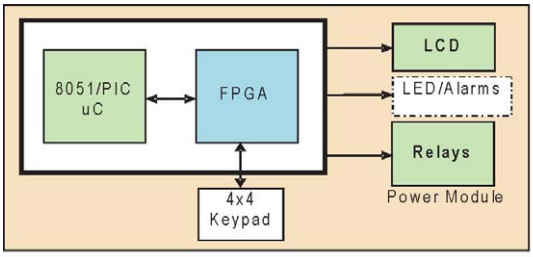


USDP for AC line applications

down the 230Vac to 2.3Vac, which can be interfaced with ADC and processed for any variation in parameters.

Access Control System

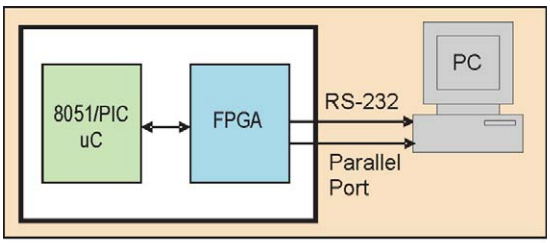
Today many applications are developed for security and access



system. The basic applications of access control can be developed and prototyped on USDP. The basic model consists of keypad interface for password entering, solenoid for door open & close which can be replaced with relays here, user display for welcome notes, menus and messages and protocol for security maintenance.

PC based Applications

Today most of the applications are having PC communication or control. For communication with PC **USDP** provides both ***serial*** and ***parallel*** communication. Parallel port connector is provided on



FPGA cards which can used to communicate with PC from it's parallel port. Also every microcontroller is equipped with RS-232 communication port for serial communication with PC. With the use of RS-232 to irDA converters & RS-232 to USB converters engineers can communicate with other protocols too. Hence USDP is an ideal prototype for such PC controlled application development.

8051 Microcontroller based Applications

USDP provides excellent support for development and implementation of microcontroller based applications. The user gets two top of the line microcontroller development cards based on 89c51RD2 and PIC 16F877. Using these controller cards the designer gets the choice for selecting the controller depending on the application requirement. As 89c51 is based on 8051 architecture the learners feels comfortable and gets the exposure for practical design development and also the PIC 16F877 which is

USDP for Microcontroller based applications

RISC based architecture gives them a real learning experience.

Other Digital Experiments and Practicals

Design of 8/16/24/32 bit counters & shift registers, Adders and subtractors, 4-bit and 8-bit ALUs, Timer designs IC8254 & IC8253, 8255 PPI design, Micro-processor design development using HDL, All digital logic gates and functions.

Training Features of USDP

- Θ Single board / platform for all types of training courses / on Embedded and VLSI.
- Θ Suitable for Advanced and Beginner Courses / Training and workshops.
- Θ Easy customization of board for training needs of different architectures in VLSI / Embedded.
- Θ Easy and simple to use with very User-friendly interface; making learning the platform operation easy for students / beginners.
- Θ Exhaustive Students manual and Instructors guide available with solved examples, covering basic and advanced topics.
- Θ Practical learning of system design concepts for budding engineers.

Development Features of USDP

- Θ Single Board / Platform for complete system design covering all parts in the system like FPGA / μP / μC / Embedded / SoB on a single platform.
- Θ Multi architecture support for FPGA / μP / μC allowing evaluation of design performance on different devices like Xilinx, Altera, etc…in VLSI and 89c51,PIC, etc… in embedded.
- Θ High speed and reliable System Interconnection Bus with proper signal integrity and low skew capable board.
- Θ Specially mounted High speed gold plated and shielded connectors for signal integrity.
- Θ Specially designed Clock network for low board level skew between components.
- Θ Specially designed High current capacity power supply for High Speed system, power needs.

Universal Platform …Integration Solved

This incisive system development platform provides universality for prototyping exceedingly complex applications based on VLSI, Embedded Systems, DSP, Power Electronics and Microcontrollers. This means - One platform for complete system development solutions.