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A COST-PERFORMANCE ANALYSIS OF EMBEDDED SYSTEMS FOR LOW AND MEDIUM-VOLUMES APPLICATIONS

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INTRODUCTION

Today's products represent a new generation of capabilities that fuse together sensors, actuators and electronics. Most of manufacturers include embedded systems (EmS) in their products. Because of certain application requirements, engineers have to approach embedded design in a different way than other types of designs.

Depending on the embedded applications, designers need to consider the design constraints. Determining which solution best fits the embedded application often mixes technical and business considerations. Technical ones include design's performance metrics. Business considerations typically address projected volumes, design cost, engineering resources, risk analysis.

This set of challenges is the reality that embedded design engineers face today. As consumer demand increases, manufacturers of embedded devices look for solutions to optimize the cost and performance of their products.

In the literature a number of papers which focuses on the estimation and optimization of the performance of embedded systems for real-time applications can be found [1, 2].

In general, modeling embedded systems constraints, as well as early estimation of embedded systems designs are hot topics. More than ever, embedded systems designers must develop cost-effective systems.

Based on the above points, designers must review available technologies and select which platform will fulfill all the requirements while balancing performance, cost, and time-to-market.

The paper concentrates on the cost-performance analysis of embedded systems for small or medium designs and/or low and medium-volumes applications.

1. OPTIONS IN CHOOSING THE PLATFORMS FOR SYSTEM DESIGN

Generally speaking, an EmS represents an analog-digital electronic system. Usually, embedded systems contain sensors, actuators, and electronics needed for processing the acquired information and controlling the attached actuators. An EmS is designed for operation in the real world. The real world operates in an analog fashion – that is, continuously. For this reason, analog circuits, such as sensors and actuators are used to interface the surrounding environment. On the other hand, the processing electronics is digital. Digital processing units are used for algorithmic control and data manipulation.

While developing EmS, designers need to understand different chips, their capabilities, and their architectures before creating the design. Hardware component selection includes choosing the processor, peripherals, and memories which will compose the EmS. A key decision is choosing the right processing unit [3]. Most embedded applications require highly customized hardware. At the same time, developers want flexible, modular solutions that can be modified to serve new markets or meet future needs.

Depending on the desired flexibility and on the importance of cost (area) and power dissipation, different options exist for the implementation of processing and control algorithms. There are platforms, such as microprocessors (MPU), microcontrollers (MCU), digital signal processors (DSP) in the area of embedded applications.

By taking advantage of MCUs, dedicated peripherals, and predefined software libraries, embedded designers are able to implement their designs quickly with the latest technologies. Depending on the application requirements, embedded designers have a wide range of solutions, from low-cost 8-bit microcontrollers to high-end microcontrollers and top-performing, 32-bit embedded processors families from Atmel, Texas Instruments, Intel, Silicon Labs, to name a few.

On the other hand, programmable logic devices (PLD), application-specific integrated circuits (ASIC), and systems on a chip (SoC) are typical circuits in the area of embedded applications.

Complex programmable logic devices (CPLD) are low-cost devices for any digital control function. Field-programmable gate arrays (FPGA)