EMBEDDED SYSTEMS – AN INTRODUCTION

Introduction to Embedded systems:

Hai, this article pictures the very basics of embedded system for a beginner**.**

Embedded System – What is it?

Whenever I hear the term "**Embedded System**", what comes to mind is "A combination of hardware and software" as instructed at the colleges. Well, instead of calling it as merely a combination of hardware and software, it would be apt to define it as application specific, organized hardware, controlled by specific software in which the hardware and software are the components of the embedded system. And there are many versions of the definition of embedded system which ultimately culminate as said above.

"Parts" of an embedded system?

Mainly, the hardware components constitute power source, microcontroller/microprocessor, timers, memory, and whatever needed for running the specific task. And the software components constitute programs such as compilers, integrated development environments (IDE), assemblers, simulators etc., which are used to create codes that "instruct" the hardware to do the assigned job in an efficient manner. Notable computer languages that are used for programming in embedded systems are embedded C, embedded C++, embedded JAVA and assembly. Here embedded C and others contains specific library for a microcontroller to work. (Like the specific header files such as math.h, conio.h). Mostly, for simple applications, assembly is used, which produces more efficient, compact codes.

Some of the open source operating systems used in embedded systems are Android, Micro controller operating system (μCOS), VS works.

Secret of Processor/Controller:

Microcontroller/microprocessor is analogous to the brain of the embedded system. It performs all the calculation and decision part of the process. You would be surprised to know that the only arithmetic operation the processor/controller is capable of doing is addition! (and the modern computer too). Multiplication is repeated addition, subtraction is addition of negative numbers and division is repeated addition of negative numbers.
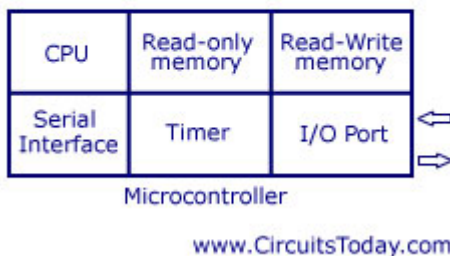
War at the core – processor vs. controller:

Well, we have already written a good article pointing out the **basic differences between a microprocessor and microcontroller**. Have a go through for better understanding.

Schematic Arrangement of a Microprocessor Based System
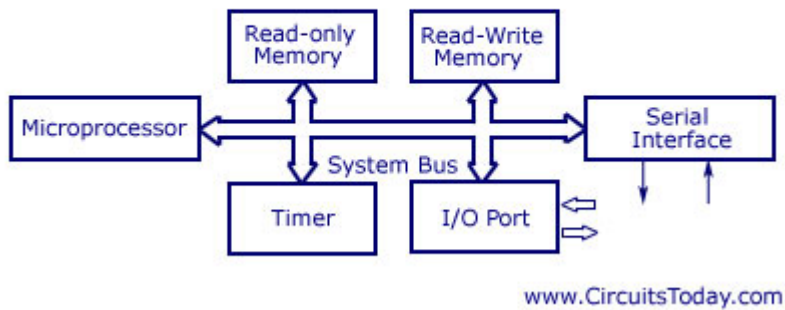
Schematic Internal Architecture of a Microcontroller

In most of the embedded systems, microcontroller is chosen. Because, as you all know, we can call the microcontroller as a mini-computer. The microcontroller integrates many useful components such as memory, timers, counters, ADC, DAC etc onto the same package along with the controller. In contrast, for a microprocessor, timers, counters are to be provided separately and memory should also be interfaced separately which involves some additional circuitry and again which eats more space. One of the major goals of embedded system devices is compactness. Hence, embedded system vendors mostly adopt for microcontrollers. This doesn't mean that microprocessor is less applicable! It is as important as the microcontroller which has its own applications. In general, microcontroller is designed for a specific purpose. [For example, an automatic washing machine, a cell phone etc. Of course you can implement the same cell phone with a microprocessor, but it takes too much space and also as much circuitry is involved, more power is consumed.] But microprocessor is designed for a general purpose. Same microprocessor can be used for designing an automatic washing machine and also a cell phone, but that's not the case with microcontrollers, its specific for a specific device. On summarizing, we can roughly refer the microcontroller as an enhanced microprocessor, enhanced for a specific task.

Some Examples:

Many companies such as Integrated electronics, Microchip, Atmel, Philips, Hitachi manufactures microcontrollers. Most notable among them are, 8051 from Intel, PIC series from Microchip, AVR series from Atmel, 68HC11 and HD44780 LCD controller from Hitachi. The PIC controllers are mostly used by hobbyists. Some examples of the embedded system worth mentioning are, cell phones, air conditioner, car dashboard control, PMPs, robots, scientific calculators etc.

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