Unit 1 Introduction to Microcontroller

Dr. Lalchand B Patle

Asst. Professor

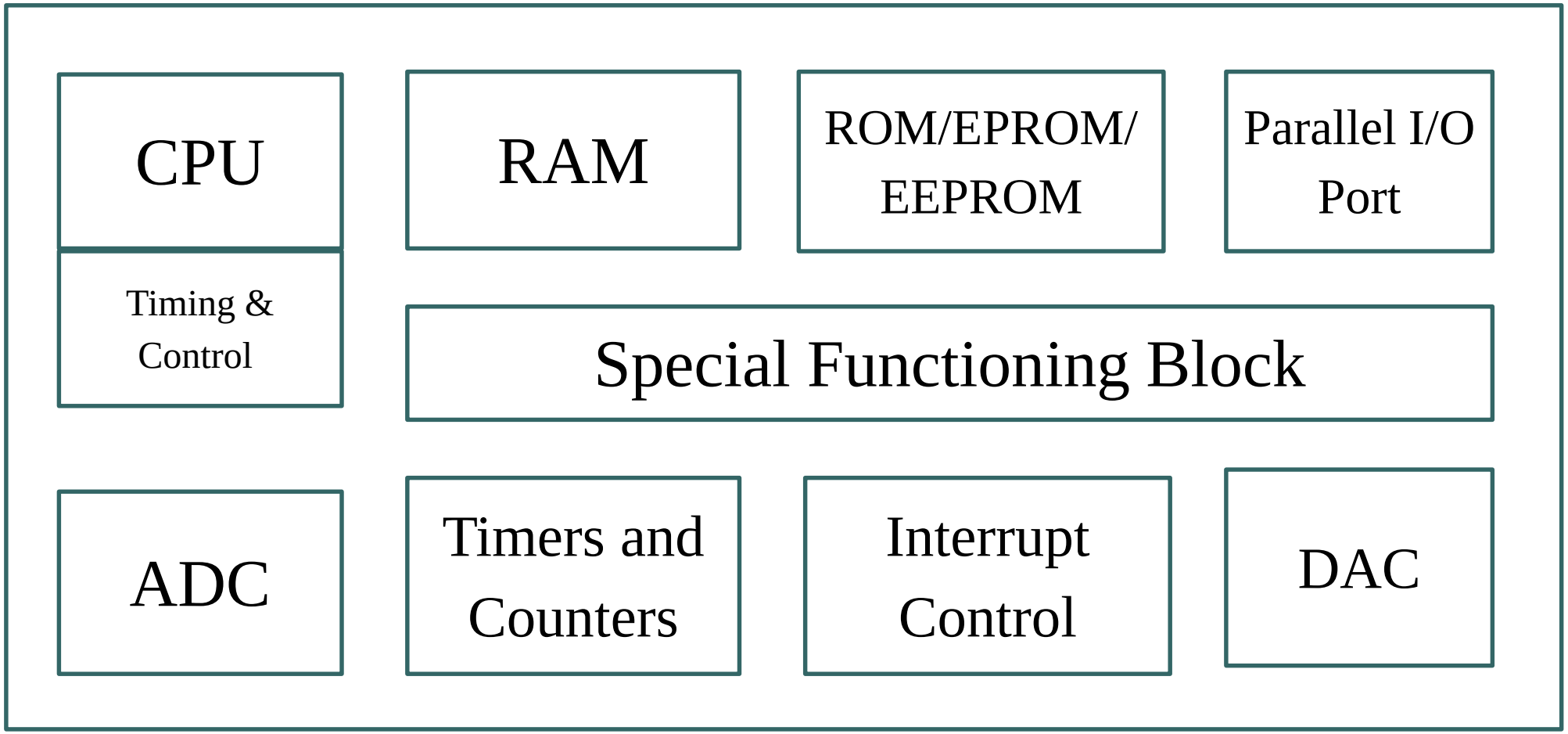
Dept. of Electronics

MGSM's ASC College Chopda, Dist: Jalgaon

Introduction

- A microcontroller is an electronic device belonging to the microcomputer family.
- These are fabricated using the VLSI (**V**ery **L**arge **S**cale **I**ntegration) technology on a single chip.
- Microcontroller is also known as “Computer-on-a-Chip”.
- It is named so, because not only the CPU, but RAM, ROM, I/O ports, Timer/Counter, Serial I/Os all are put together on a single microcontroller chip.
- A microcontroller also called an embedded controller because the microcontroller and its support circuits are often built into, or embedded in, the devices they control.
- A microcontroller is available in different word lengths like microprocessors (4bit, 8bit, 16bit, 32bit, 64bit and 128-bit microcontrollers are available today).

Block Diagram of Microcontroller



Memory

- Memory spaces such as RAM, ROM, EPROM or EEPROM are there to store data and programs.
- For data storage, volatile memory RAM is used while for the program and operating parameter storage ROM and other memory spaces are used.
- A microcontroller usually has a certain amount of RAM and ROM (EEPROM, EPROM, etc) or flash memories for storing program source codes.

Timers/counters

- This is the one of the useful function of a microcontroller.
- A microcontroller may have more than one timer and counters.
- The timers and counters provide all timing and counting functions inside the microcontroller.
- The major operations of this section are performed clock functions, modulations, pulse generations, frequency measuring, making oscillations, etc.
- This also can be used for counting external pulses.
- There is a watchdog timer. A watchdog timer is a portion of hardware that can be used to automatically detect software anomalies/malfunctions and reset the processor if any occur

Parallel input/output ports

- Parallel input/output ports are mainly used to drive/interface various devices such as LCD’S, LED’S, printers, memories, etc to a microcontroller.

Serial ports

- Serial ports provide various serial interfaces between a microcontroller and other peripherals like parallel ports.

Interrupt control

- The interrupt control used for providing interrupt (delay) for a working program.
- The interrupt may be external (activated by using interrupt pin) or internal (by using interrupt instruction during programming).

Special functioning block

- Some microcontrollers used only for some special applications (e.g. space systems and robotics) these controllers containing additional ports to perform such special operations.
- This considered as special functioning block.

Analog to Digital Converter (ADC)

- ADC converters are used for converting the analog signal to digital form.
- The input signal in this converter should be in analog form (e.g. sensor output) and the output from this unit is in digital form.
- The digital output can be used for various digital applications (e.g. measurement devices).

Digital to Analog Converter (DAC)

- DAC perform reversal operation of ADC conversion. DAC converts the digital signal into analog format.
- It usually used for controlling analog devices like DC motors, various drives, etc.

Advantages of microcontroller

- The main advantages of microcontrollers are given.
- Microcontrollers act as a microcomputer without any external digital parts.
- As the higher integration inside microcontroller reduces cost and size of the system.
- Usage of a microcontroller is simple, easy to troubleshoot and system maintaining.
- Most of the pins are programmable by the user for performing different functions.
- Easily interface additional RAM, ROM, I/O ports.
- Low time required for performing operations.

Disadvantages of Microcontrollers

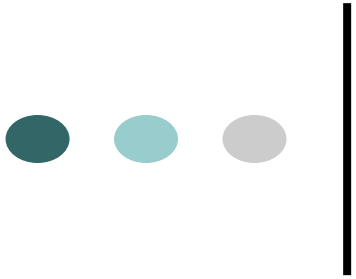
- Microcontrollers have got more complex architecture than that of microprocessors.
- Microcontrollers are used for dedicated application only.
- Only perform a limited number of executions simultaneously.
- Mostly used in micro-equipment.
- Cannot interface high power devices directly.

Comparison between microprocessor and microcontroller

Sr. No.	Microprocessors	Microcomputer
1	It is only a general purpose computer CPU	It is a microcomputer itself
2	Memory, I/O ports, timers, interrupts are not available inside the chip	All are integrated inside the microcontroller chip
3	Systems become bulkier and expensive.	Make the system simple, economic and compact
4	Microprocessors have many opcodes for moving the data from external memory to CPU.	Microcontrollers have one or two opcodes for moving the data.
5	Higher accessing time required	Low accessing time
6	Very few number of bit handling instructions	Many bit handling instructions
7	Very few pins are programmable	Most of the pins are programmable
8	Widely Used in modern PC and laptops	widely used in small control systems and dedicated applications
9	E.g. INTEL 8086, INTEL Pentium series etc.	E.g. INTEL8051, 89960, PIC16F877 etc.

Applications of microcontroller

- **1. Consumer Electronics Products:**
  - Toys, Cameras, Robots, Washing Machine, Microwave Ovens etc. [any automatic home appliance]
- **2. Instrumentation and Process Control:**
  - Oscilloscopes, Multi-meter, Leakage Current Tester, Data Acquisition and Control etc.
- **3. Medical Instruments:**
  - ECG machine, Electronic Cardiac Monitor, Blood gas analyzer, Blood Glucose Monitor, MRI Machine etc.
- **4. Communication:**
  - Cell Phones, Telephone Sets, Answering Machines etc.
- **5. Office Equipment:**
  - Fax, Printers, etc.
- **6. Multimedia Application:**
  - Mp3 Player, PDAs, optical players, digital camcorders etc.
- **7. Automobile:**
  - Speedometer, Auto-breaking system etc.
- **8. Robotics:**
  - Domestic or household robots, Industrial robots, Medical robots, Service robots, Military robots, Entertainment robots, Space robots,



Thank You