ELECTRONIC PRINCIPLES AND DEVICES

Unit 4 –DIGITAL ELECTRONICS

ELECTRONIC PRINCIPLES AND DEVICES

General Purpose and domain specific processors.

Department of Electronics and Communication.

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Core of the Embedded System

- Embedded systems are domain and application specific and are built around a central core
- The core of the embedded system falls into any of the following categories:
  1. General purpose and Domain Specific Processors
     1. Microprocessors
     2. Microcontrollers 1.3. Digital Signal Processors
  2. Application Specific Integrated Circuits (ASIC)
  3. Programmable logic devices(PLD's)
  4. Commercial off-the-shelf components (COTs)

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GENERAL PURPOSE AND DOMAIN SPECIFIC PROCESSOR

- Almost 80% of the embedded systems are processor/ controller based
- The processor may be microprocessor or a microcontroller or digital signal processor, depending on the domain and application

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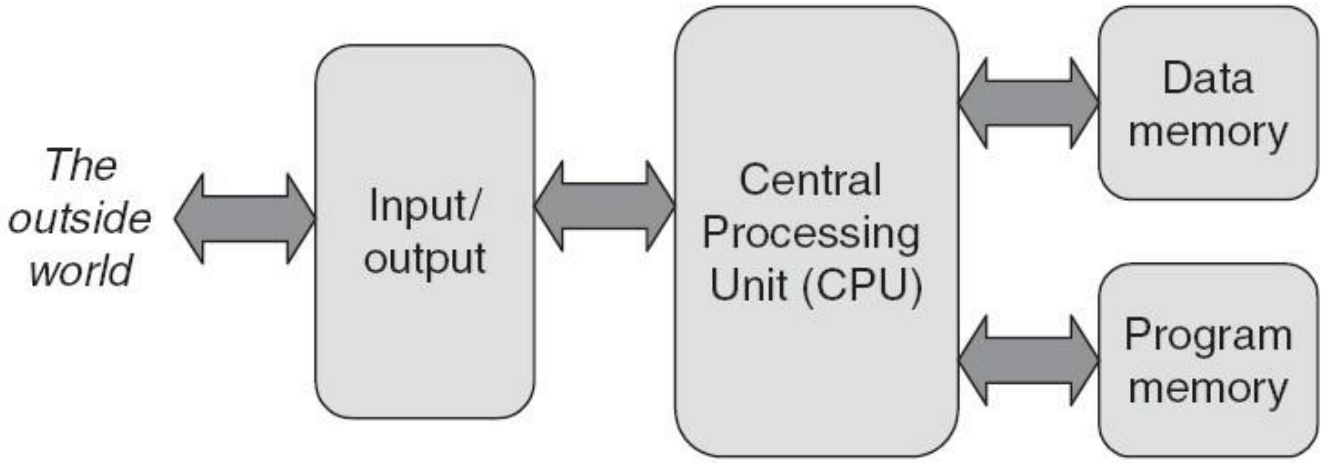

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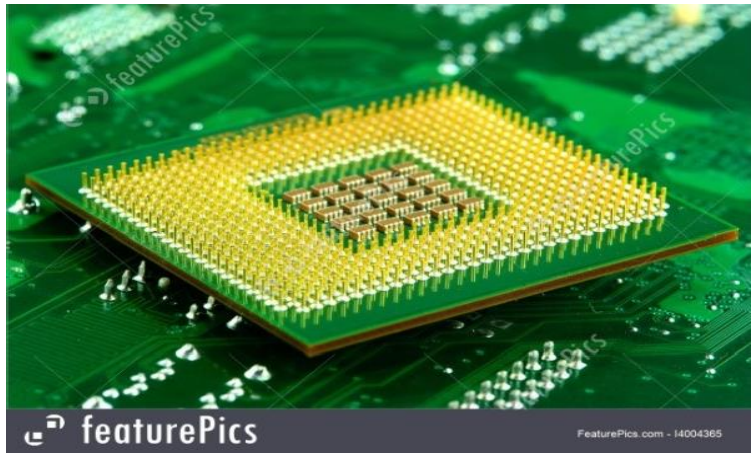
Microprocessors

❖ A microprocessor is a silicon chip representing a central processing unit



❖ A microprocessor is a dependent unit and it requires the combination of other hardware like memory, timer unit, and interrupt controller, etc. for proper functioning

❖ Architectures used for processor design are Harvard or Von-Neumann

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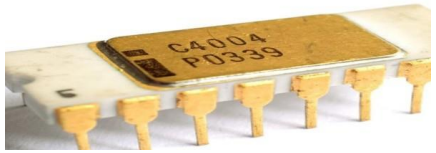
Microprocessors

❖ **Developers of microprocessors**

- ✓ Intel – Intel 4004 – November 1971(4-bit)
- ✓ Intel – Intel 4040
- ✓ Intel – Intel 8008 – April 1972
- ✓ Intel – Intel 8080 – April 1974(8-bit)
- ✓ Motorola – Motorola 6800
- ✓ Intel – Intel 8085 – 1976
- ✓ Zilog - Z80 – July 1976



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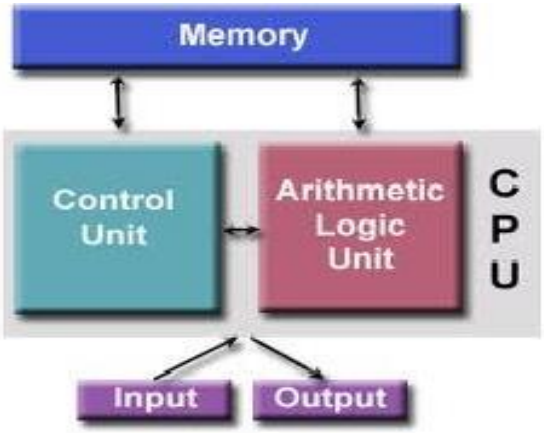
Processors in a System

❖A processor has two essential units –

- ✓Program Flow Control Unit (CU)
- ✓Execution Unit (EU)



➢The CU includes a fetch unit for fetching instructions from the memory

➢The EU has circuits that implement the instructions pertaining to data transfer operation and data conversion from one form to another

Processors in a System

- The EU includes the Arithmetic and Logical Unit (ALU) and also the circuits that execute instructions for a program control task such as interrupt, or jump to another set of instructions

- A processor runs the cycles of fetch and executes the instructions in the same sequence as they are fetched from memory

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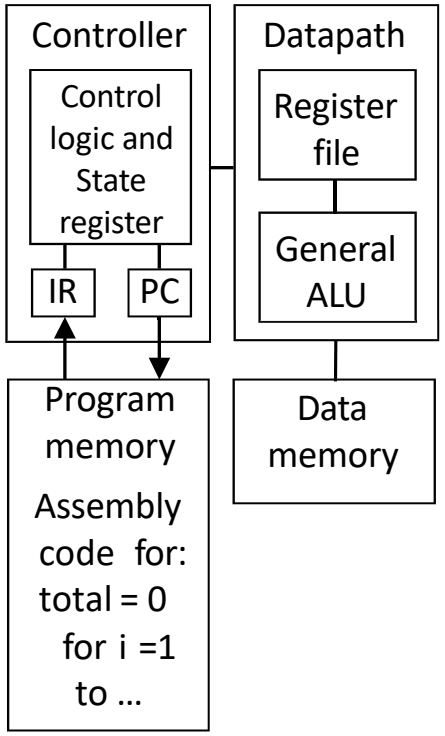
General Purpose Processors

- Programmable device used in a variety of applications
  - ✓ Also known as “microprocessor”
- Features
  - ✓ Program memory
  - ✓ General data path with large register file and general ALU
- User benefits
  - ✓ Low time-to-market and NRE costs
  - ✓ High flexibility
- “Pentium” the most well-known, but there are hundreds of others



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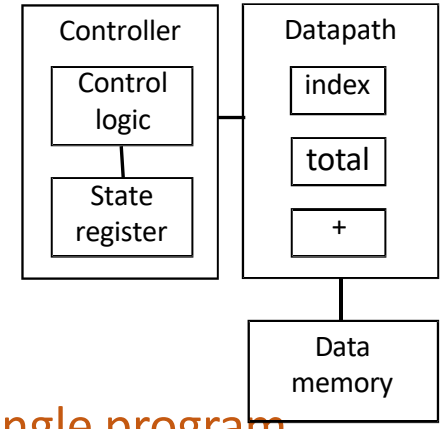
Single-purpose processors

- Digital circuit designed to execute exactly one program
  - ✓a.k.a. coprocessor, accelerator or peripheral



- Features
  - ✓Contains only the components needed to execute a single program
  - ✓ No program memory
  - Benefits
  - ✓ Fast
  - ✓ Low power
  - ✓ Small size

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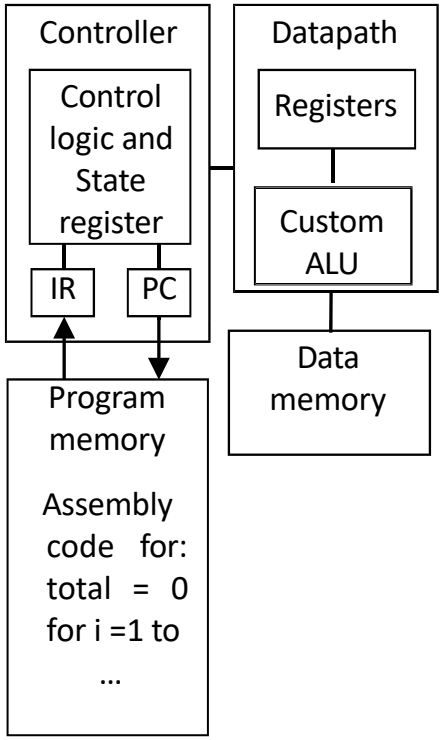
Application-Specific Processors

- Programmable processor optimized for a particular class of applications having common characteristics
  - ✓ Compromise between general-purpose and single-purpose processors
- Features
  - ✓ Program memory
  - ✓ Optimized data path
  - ✓ Special functional units
- Benefits
  - ✓ Some flexibility, good performance, size and power

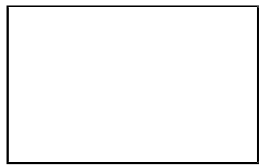


Processor Technology

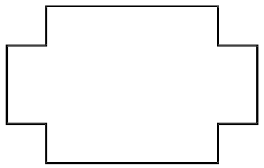
- Processors vary in their customization for the problem at hand

Desired functionality

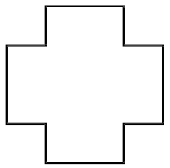
```
total = 0
for i = 1 to N  loop
    total += M[i]
end loop
```



General-purpose processor



Application-specific processor



Single-purpose processor

THANK YOU

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