SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

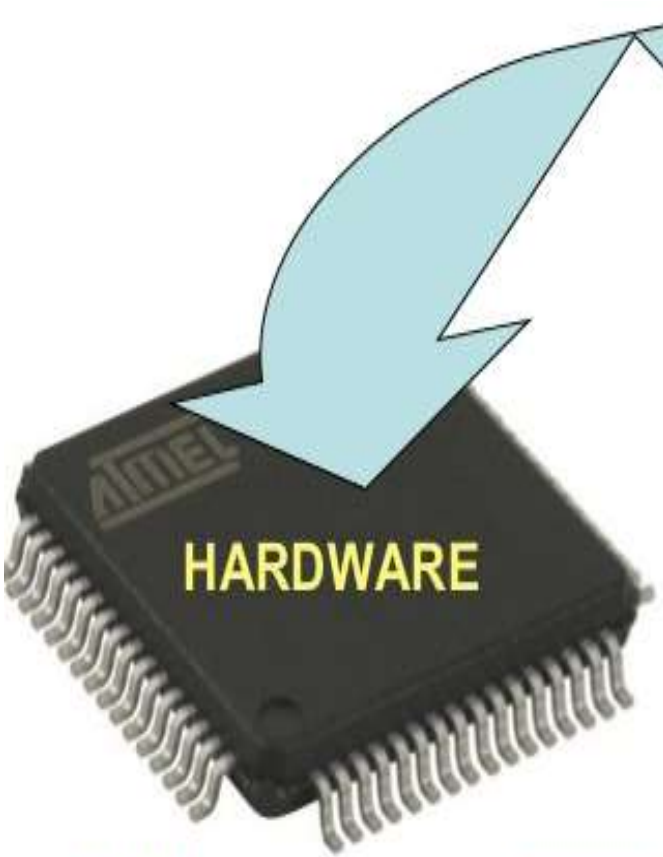
19ITT204 - MICROCONTROLLER AND EMBEDDED SYSTEMS

II YEAR/ IV SEMESTER

UNIT III EMBEDDED SYSTEM CONCEPTS AND PROCESSORS

TOPIC – Introduction to Embedded Systems

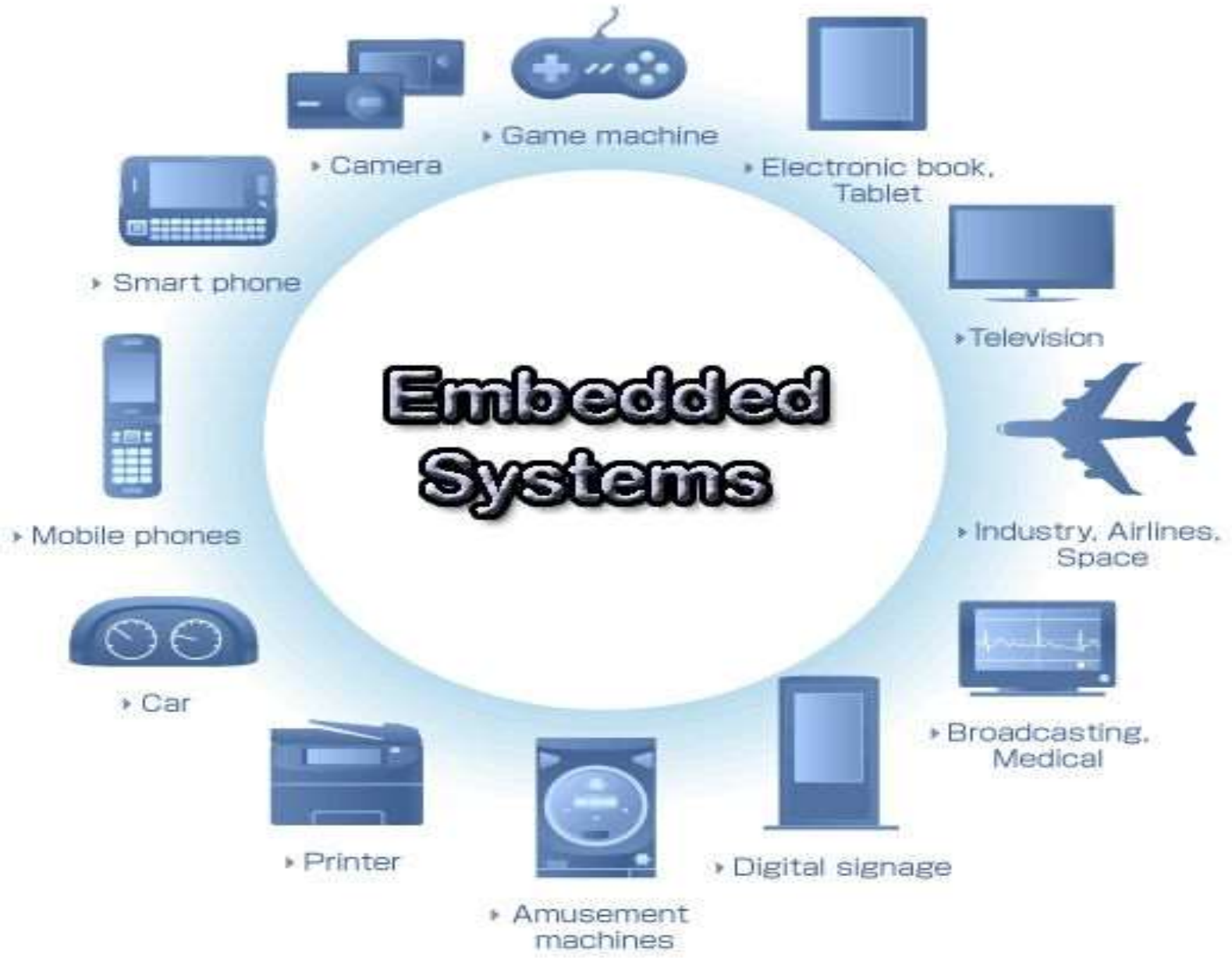
What a Embedded System Is???



SOFTWARE PROGRAM

```
#include <16f876a.h>
#use delay (clock=20000000)
#byte PORTB=6
main()
{
set_tris_b(0);
portb=255;       //decimal
delay_ms(1000);
portb=0x55;      //hexadecimal
delay_ms(1000);
portb=0b10101010;  //binary
delay_ms(500);
}
```

Examples Embedded System



Components in Embedded System

Touch Sensor

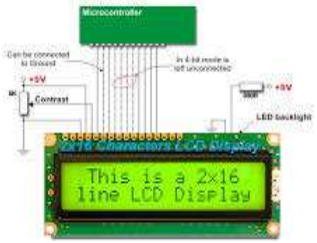
Ultrasonic Sensor

PIR Sensor

Speed Sensor

Temperature Sensor

Different Types of Sensors and Their Applications



System

A system is a way of working, organizing or doing one or many tasks, which are performed in a system according to a fixed plan, program or set or rules

General Computing System Components

- *Microprocessor*
- *Large memory*
- *Input Units*
- *Out put Units*
- *Networking Units*
- *An Operating System*

Embedded System

*An embedded system is a system that has **embedded software in a computer hardware**. The system is dedicated for either an application(s) or specific part of an application or product or a component of a large system*

Eg.

- ✓ *Washing machine*
- ✓ *Cooking machine*
- ✓ Automative chocolate vending machines
- ✓ *Multitasking toys*

Classification of Embedded System

i. Small Scale Embedded Systems

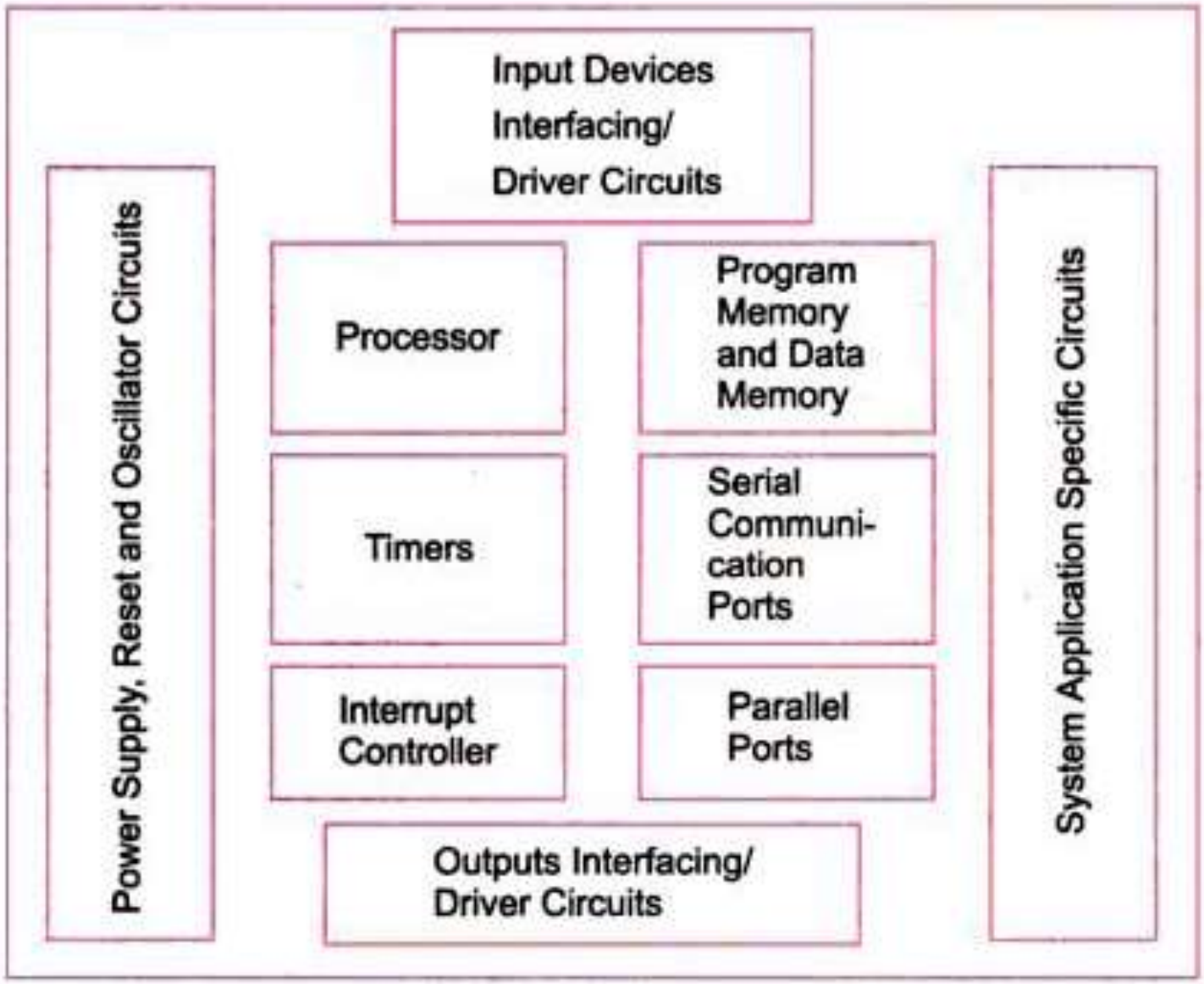
ii. Medium Scale Embedded Systems

iii. Sophisticated Embedded Systems

Embedded System Components

- *It embeds **Hardware** similar to a computer*
- ***Software** usually embeds in the ROM, flash memory or media card*
- *It embeds a Real Time Operation System (**RTOS**)*

Components of Embedded System Hardware



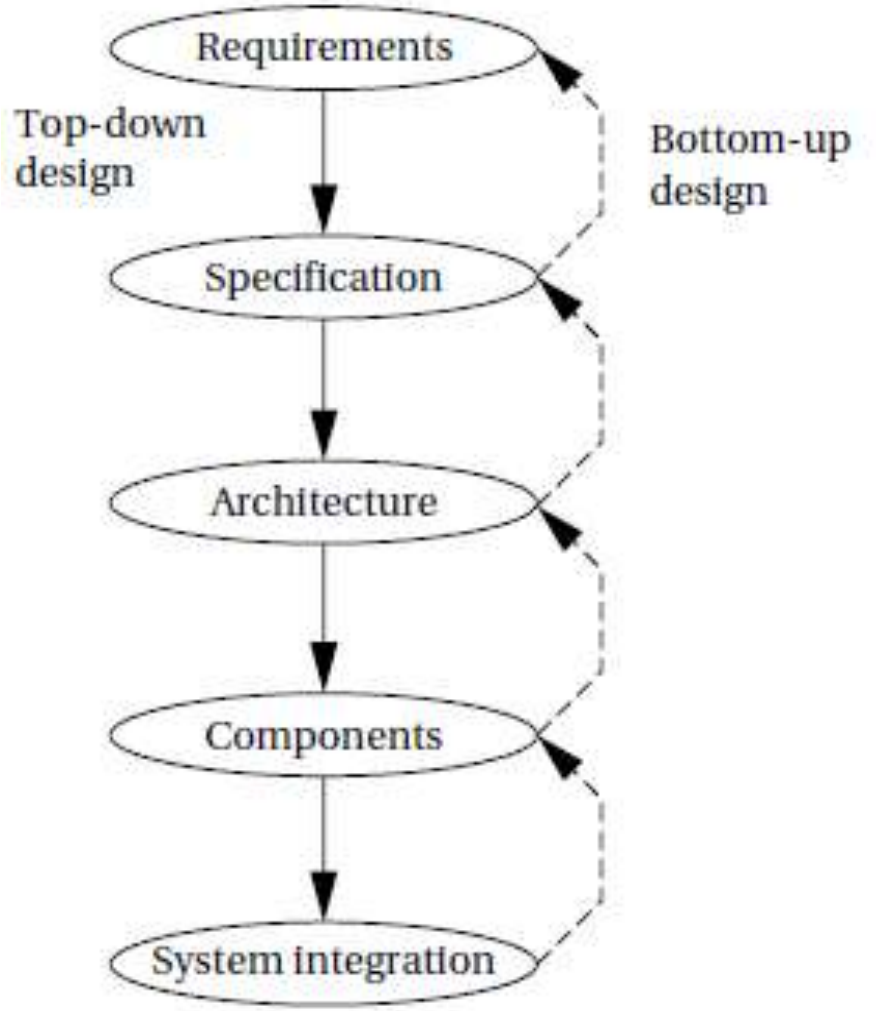
Building Blocks of Embedded System Hardware

- The Hardware consists of following building blocks and devices:
  - Power source
  - Clock Oscillator and Clocking Units
  - System Timer
  - Real Time Cock
  - Reset Circuit
  - Power Up Reset
  - Watchdog Timer Reset
  - Memory
  - I/O ports
  - I/O buses
  - I/O Interfaces
  - DAC
  - ADC

Design Process in Embedded System

- Design Metrics
  - Power Dissipation
  - Performance
  - Process Deadlines
  - User Interfaces
  - Size
  - Engineering Cost
  - Manufacturing Cost
  - Flexibility
  - Prototype Development Time
  - Time to Market
  - System and User Safety
  - Maintenance

Abstraction of Steps in Design Process



Embedded System Characteristics

- System functions in real time
- Program is preloaded in the ROM(s) or flash memory
- Dedicated set of functions
- Complex dedicated purpose preprogrammed
  - algorithms
  - Hardware
  - Graphics and Other user interfaces
- Multirate operations with different predetermined time constraints to finish the different operations

Constraints of Embedded Systems

- Available System Memory
- Available Processor Speed
- Meeting Deadlines
- Performance
- Power
- Size
- Design and Manufacturing Cost

Selection of Processor

- Different systems require different processor features
- The processor is selected from the following considerations
  - **Instruction Set**
  - **Maximum bits** in an operand in an operation
  - Processing Speed
  - **Ability to solve the complex algorithms**
  - A processor gives high **computing performance** when it has
    - Pipeline and Superscalar architecture
    - Pre-fetch cache unit, caches, register files and MMU
    - RISC core architecture

Selection of Processor

- A processor with **register windows** provides fast **context switching** in a multitasking system
- Processor has **auto shut down** features for its units
- A processor with **burst mode** accesses external memories fast