SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB211 – Microcontroller Programming & Interfacing

II YEAR/ IV SEMESTER

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UNIT 5 – Advanced Microcontrollers

TOPIC 1 – MSP430 and peripherals

Introduction to MSP430

➢ MSP430 family microcontrollers from Texas Instruments (TI), are designed for low cost, low power and portable embedded applications

➢ MSP430 has 16-bit RISC based processor architecture

➢ It supports different Low power modes

➢ It has 16 registers (R0-R15)

➢ All registers are 16-bit wide

➢ It has 16-bit Address bus and 16-bit data bus

➢ Supports 27 core instructions, 24 emulated instructions and 7 addressing modes

➢ It is capable of wake-up time below 1 microsecond

➢ Extensive vectored-interrupt capability

➢ A wide range of on-chip peripherals are available

Features to MSP430

➢ Although there are variants in devices in the family, a MSP430 microcontroller can be characterized by

Device parameters
- Flash/ ROM options: 1 KB – 60 KB
- RAM options: 128 B– 8 KB
- GPIO options: 14 - 80 pins

Clock and Power Specifications
- CPU clock : 8/16/25 MHz
- Operating voltage : 1.8–3.6
- Active operation : 160 - 250 µA/MIPS
- RTC mode operation : 0.7 µA
- RAM retention : 0.1 µA
- Fast wake-up from standby mode in less than 1 µs

Integrated peripherals of MSP430

- ➢ Basic Clock system

- ➢ 10/12/16-bit ADC

- ➢ I/O ports

- ➢ 12-bit dual DAC

- ➢ Serial Port : SPI, I2C, UART

- ➢ Op-Amp

- ➢ Timers

Integrated peripherals of MSP430

- Comparator A

- WDT (Watch Dog Timer)

- Temp. sensor

- RTC (Real Time Clock)

- Multiplier

- DMA

- LCD driver

- Supply Voltage Supervisor (SVS)

- Brown out Reset

- The emulator and JTAG interface

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Advantages of MSP430

➢ 16-bit RISC architecture

➢ High-performance - High speed of execution

➢ Low power consumption

➢ Fast wake-up from standby mode in less than 1 µs

➢ Variety of models with integrated memories, multiple programmable GPIO and Integrated application-specific peripherals

➢ Cost-effective

Applications of MSP430

➢ Low power, hand-held smart devices
➢ Test and measurement equipment
➢ Smart Energy/Smart Grid solutions
➢ Factory automation
➢ Home and commercial site monitoring and control
➢ Medical instrumentation
➢ Fire and security
➢ Intelligent lighting control
➢ Transportation
➢ Motion control
➢ Automobiles
➢ Gaming equipment

Variants of MSP430 Family

➢ **MSP430x1xx** : Provides a wide range of general-purpose devices from simple versions to complete systems for processing signals

➢ **MSP430x2xx** :similar to the '1xx generation, but operate at even lower power, support up to 16 MHz operation

➢ **MSP430x3xx** :The MSP430x3xx Series is the oldest generation, designed for portable instrumentation with an embedded LCD controller

➢ **MSP430x4xx** :MSP430x4xx series can drive LCDs with up to 160 segments

➢ **MSP430x5xx :** The MSP430x5xx Series are able to run up to 25 MHz, have up to 512 KB flash memory and up to 66 KB RAM

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Variants of MSP430 Family

Variants of MSP430 family	MSP430x1xx	MSP430x2xx	MSP430x3xx	MSP430x4xx	MSP430x5xx
Clock	8 MHz	16 MHz	16 MHz	16 MHz	16 MHz
I_{active} /MIPS	200 μA	200 μA	160 μA	200 μA	165 μA
$I_{RTC\ mode}$	0.7 μA	0.7 μA	0.9 μA	0.7 μA	2.5 μA
I_{RAMret}	0.1 μA	0.1 μA	0.1 μA	0.1 μA	0.1 μA
Wake-up time	< 6 μs	< 1 μs	< 6 μs	< 6 μs	< 5 μs
Flash/ROM	1-60KB	1-60KB	2-32 KB	4-60 KB	up to 512KB
RAM	128 B -2KB	128 B -2KB	512 B -2KB	256 B -2KB	up to 66KB
GPIO	10-48	10-48	14-40	14-80	32-90

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THANK YOU