



EMBEDDED SYSTEMS

Assignment One

الإسم : عبد الرحمن محمود محمد محمد حسن

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01-Introduction

Microcontrollers are essential components in modern electronics, controlling embedded systems across various industries. They come in different families, each optimized for specific applications, with diverse brands offering a range of features. This report explores key microcontroller families and compares two popular options: the PIC16F877A and TM4C123GH6PM.

02- Microcontroller Families and Brands Overview

Microcontroller families are typically categorized based on their architecture, performance, and application area. Some prominent families include:

- **AVR:** Created by Atmel (now part of Microchip), AVR microcontrollers are versatile 8-bit devices commonly used in academic projects, DIY electronics, and platforms like Arduino. Their simplicity and accessibility make them ideal for educational purposes and hobbyist projects.
- Example: ATmega328P
- **PIC (Peripheral Interface Controller):** Developed by Microchip, PIC microcontrollers are renowned for their simplicity and versatility. Available in 8-bit, 16-bit, and 32-bit architectures, they are often used in low-cost projects, home automation, and robotics due to their built-in peripherals like ADCs and timers.
-Example: PIC16F877A

- **MSP430:** Designed by Texas Instruments, the MSP430 series is renowned for its ultra-low-power consumption, making it ideal for battery-powered devices and portable applications such as wearables and medical devices. Its efficient power management makes it suitable for long-term energy-sensitive projects.
- Example: MSP430G2553
- **ARM Cortex-M:** Licensed by ARM, the Cortex-M series is used in high-performance, low-power applications such as automation, IoT, and motor control systems. Cortex-M microcontrollers are known for their 32-bit architecture and powerful processing capabilities, supporting advanced communication protocols
-Example: TM4C123GH6PM
- **ESP Series:** Developed by Espressif Systems, the ESP32 and ESP8266 are microcontrollers designed for IoT applications due to their built-in Wi-Fi and Bluetooth capabilities. They are widely used in smart home devices and connected systems that require wireless communication.
- Example: ESP32
- **Intel 8051 Family:** One of the oldest microcontroller families, the 8051 series remains popular for basic embedded systems and educational purposes. Known for its simplicity, the 8051 is commonly used in tasks like keypad control, LED lighting, and basic automation.
-Example: AT89C51

03- Comparison between PIC16F877A and TM4C123GH6PM

Feature	PIC16F877A	TM4C123GH6PM
Architecture	8-bit RISC	32-bit ARM Cortex-M4
Clock Speed	20 MHz	80 MHz
Program Memory	14 KB Flash	256 KB Flash
RAM	368 Bytes	32 KB
I/O Pins	33	43
Peripherals	ADC, UART, SPI, I2C, PWM	ADC, UART, SPI, I2C, PWM, USB, FPU
Power Consumption	Low	Higher due to higher performance
Use Case	Simple, low-cost applications	Complex, real-time systems

03- Comparison between PIC16F877A and TM4C123GH6PM cont.

Feature	PIC16F877A	TM4C123GH6PM
EEPROM	256 bytes	supports external memory
Floating-Point Unit	Not available	Available
Cost	Lower cost.	Higher Cost.
I2C Support	Yes	Yes
USB Support	No	Yes
Max Current Consumption	20 mA	70 mA
Max GPIO Current per Pin	25 mA	8 mA
Applications	Basic automation, robotics, home appliances	IoT, motor control, real-time data processing

end