Embedded Systems

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Asignment 1

• INTRODUCTION

What is a microcontroller (MCU)?

A microcontroller is a compact integrated circuit , Sometimes referred to as an embedded controller or microcontroller unit (MCU), microcontrollers are found in automobile engine control systems, robots, office machines, medical devices, mobile radio transceivers, vending machines and home appliances, among other devices. They're simple miniature PCs designed to control small features of a larger component without a complex front-end operating system.

Types of microcontrollers

Microcontrollers can be classified according to data size and architecture. Common types include the following:

- 8-bit microcontroller. These MCUs can only transmit 8 bits of data at a given time. However, they consume less power compared to larger data sizes.
- 16-bit microcontroller. These microcontrollers have higher clock speeds and more memory than 8-bit microcontrollers. They are two times faster than 8-bit microcontrollers.
- 32-bit microcontroller. These high-speed microcontrollers are faster and have more processing capacity than 16-bit ones. However, their power consumption is significantly higher.

Families of microcontrollers

There are many different families of microcontrollers, each with its own unique features and capabilities. Here are some of the most popular microcontroller families:

- **AVR:** AVR microcontrollers are produced by Atmel Corporation and are widely used in hobbyist and industrial applications. They are popular for their low power consumption, high performance, and ease of use.
- **PIC:** PIC microcontrollers are produced by Microchip Technology and are used in a wide range of applications, including automotive, industrial, and medical. They are known for their low cost, low power consumption, and ease of use.
- **ARM:** ARM microcontrollers are produced by ARM Holdings and are widely used in mobile devices, embedded systems, and other applications. They are known for their high performance, low power consumption, and versatility.
- **STM32:** STM32 microcontrollers are produced by STMicroelectronics and are used in a wide range of applications, including industrial automation, consumer electronics, and automotive. They are known for their high performance, low power consumption, and extensive range of peripherals.
- **MSP430:** MSP430 microcontrollers are produced by Texas Instruments and are used in a wide range of applications, including portable devices, medical equipment, and industrial automation. They are known for their low power consumption and high performance.
- **8051:** 8051 microcontrollers are produced by many different manufacturers and are widely used in embedded systems and other applications. They are known for their low cost, ease of use, and extensive range of peripherals.
- **Arduino:** Arduino microcontrollers are produced by Arduino LLC and are widely used in hobbyist and educational applications. They are known for their ease of use, low cost, and extensive range of libraries and shields.

• Difference between PIC and ARM

What is PIC Micro-Controller?

PIC micro-controller was initially referred as Peripheral Interface Controller and now it is referred as Programmable Intelligent Computer. It comes under the family of micro-controllers made by Microchip Technology. It was originally developed by General Instrument's Microelectronics in the year 1993. It can be programmed to carry out a vast range of tasks. PIC micro-controllers are available in 8-bit, 16-bit and 32-bit. It is based on RISC Instruction Set Architecture and Harvard memory architecture.

What is ARM Micro-Controller?

ARM micro-controller is Advanced RISC Machine which was introduced by Acorn computer organization and is manufactured by the companies Apple, Nvidia, Qualcomm, Motorola, ST Microelectronics, Samsung Electronics, and TI etc. ARM processor belongs to the family of CPUs which are based on Reduced Instruction Set Computer (RISC) and ARM microprocessor with RAM, ROM and other peripherals in one single chip, we get an ARM micro-controller. LPC2148 is an example of ARM micro-controller. It is based on RISC Instruction set Architecture (ISA). It is cost sensitive and high performance devices and used in a wide range of embedded application such as industrial instrument control systems etc.

S.No.	PIC	ARM
01.	PIC micro-controller refers to Peripheral Interface Controller.	ARM micro-controller refers to Advanced RISC Machine.
02.	PIC micro-controllers are available in 8-bit, 16-bit and 32-bit.	ARM micro-controllers are available in 32-bit mostly also available in 64-bit.
03.	It supports PIC, UART, USART, CAN, LIN, Ethernet, SPI, I2S communication protocol.	It supports UART, USART, SPI, CAN, LIN, I2C, Ethernet, I2S, DSP, SAI communication protocol.

• Difference between PIC and ARM

04.	It has an effective instruction rate of 4 clock cycles per instruction.	It has an effective instruction rate of 1 clock cycles per instruction.
05.	It uses SRAM, Flash memory.	It uses Flash, SDRAM, EEPROM memory.
06.	It is based on some feature of RISC.	It is based on RISC instruction set architecture.
07.	It is based on Harvard memory architecture.	It is based on modified Harvard architecture.

08.	PIC micro-controller family includes PIC16, PIC17, PIC18, PIC24, PIC32.	ARM micro-controller family includes ARMv4, 5, 6, 7 and series.
09.	It has a very good community support.	It has a vast community support.
10.	Its manufacturer is Microchip.	Its manufacturers are Apple, Nvidia, Qualcomm, Samsung Electronics, and TI etc.
11.	It is available with an average cost as compared to the features.	It is available with a low cost as compared to the features.
12.	Popular micro-controllers include PIC18fXX8, PIC16f88X, PIC32MXX.	Popular micro-controllers include LPC2148, ARM Cortex-M0 to ARM Cortex-M7, etc.