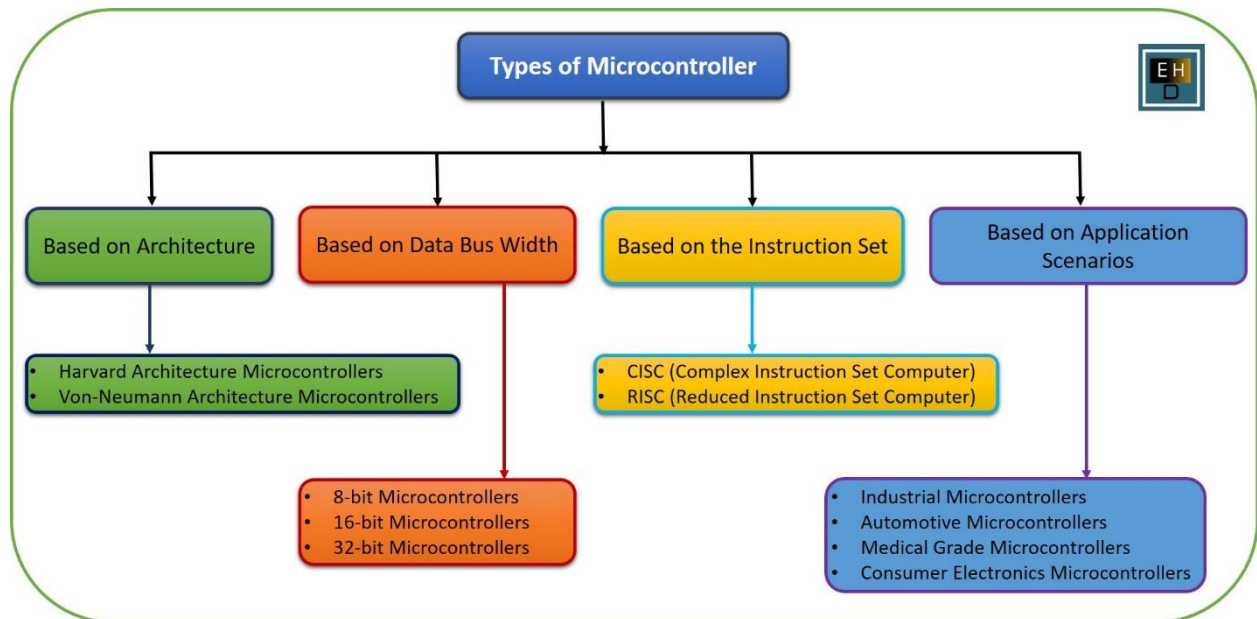# Report1

Microcontrollers

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- The different microcontroller families and brands.
  Microcontrollers are the core of embedded systems and can be categorized commonly based on the architecture, data bus width, instructions set, and application scenarios.

Types of Microcontroller

Based on Architecture
- Harvard Architecture Microcontrollers
- Von-Neumann Architecture Microcontrollers

Based on Data Bus Width
- 8-bit Microcontrollers
- 16-bit Microcontrollers
- 32-bit Microcontrollers

Based on the Instruction Set
- CISC (Complex Instruction Set Computer)
- RISC (Reduced Instruction Set Computer)

Based on Application Scenarios
- Industrial Microcontrollers
- Automotive Microcontrollers
- Medical Grade Microcontrollers
- Consumer Electronics Microcontrollers

- <u>Microcontrollers families overview</u>

  Popular families:
  - AVR
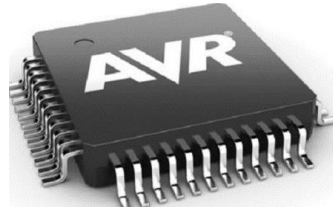 - 8051
  - PIC
  - ARM

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<u>AVR</u>

- Manufacturer: developed since 1996 by Atmel, acquired by Microchip Technology in 2016.
- Basic families:

  -tinyAVR

  -megaAVR

  -AVR Dx

- Architecture: Harvard architecture machine
- Data bus width:8 bit width
- Instructions set: The AVRs have 32 single-byte registers and are classified as 8-bit RISC devices.
- Applications:

  -AVR microcontroller is mainly used in an embedded system for the operation of high-speed signal processing.

  -These microcontrollers are used in touch screens, home automation, medical devices, defense, automobiles, etc.

  -This microcontroller can be used in many types of projects like data acquisition, motion control, For signal sensing, interface GPS, GSM, motors, displays on LCD, unmanned aerial vehicles development, etc.

8051

- Manufacturer: The 8051 Microcontroller was designed in the 1980s by Intel.
- Basic families:

  The 8051 microcontroller family consists of several variations, including the original 8051, the 8031 (which has less functionality), and the upgraded 8052. Each variant offers a different peripheral configuration and memory size to meet the needs of a particular application.

- Architecture: An 8051 microcontroller is an 8-bit Harvard architecture microcontroller

- Data bus width:

  -Address Bus: Microcontroller 8051 consists of a 16-bit address bus. It is brought into play to address memory positions. It is also utilized to transmit the address from the Central Processing Unit to Memory.

  -Data Bus: Microcontroller 8051 comprise of 8 bits data bus. It is employed to cart data.

- Applications:

The microcontroller 8051 applications include a large number of machines, principally because it is simple to incorporate in a project or to assemble a machine around it. The following are the key spots of the spotlight:

1. **Energy Management:** Competent measuring device systems aid in calculating energy consumption in domestic and industrialized applications. These meter systems are prepared competent by integrating microcontrollers.

2. **Touch screens:** A high degree of microcontroller suppliers integrate touch sensing abilities in their designs. Transportable devices such as media players, gaming devices & cell phones are some illustrations of micro-controller integrated with touch sensing screens.

3. **Automobiles:** The microcontroller 8051 discovers broad recognition in supplying automobile solutions. They are extensively utilized in hybrid motor vehicles to control engine variations. Also, works such as cruise power and anti-brake mechanism have created it more capable with the amalgamation of micro-controllers.

4. **Medical Devices:** Handy medicinal gadgets such as glucose & blood pressure monitors bring into play micro-controllers, to put on view the measurements, as a result, offering higher dependability in giving correct medical results.

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- Comparison between the PIC microcontroller and ARM microcontroller.

	PIC	ARM
Manufacturer	made by Microchip Technology	was introduced by Acorn computer organization and Its manufacturers are Apple, Nvidia, Qualcomm, Samsung Electronics, and TI etc.
Basic families	PIC micro-controller family includes PIC16, PIC17, PIC18, PIC24, PIC32.	ARM micro-controller family includes ARMv4, 5, 6, 7 and series.
Architecture	It is based on Harvard memory architecture.	It is based on modified Harvard architecture.
Data bus width	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.
Instructions set	RISC Instruction Set	RISC Instruction Set
support	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.
Advantage	**Cost-Effective:** In the PIC microcontrollers case, they are relatively cheaper and are thus suitable for any project with limited costs. **Ease of Use:** PIC devices on the other hand are simpler in their structure hence easier to program and engage simple designs. **Low Power Consumption:** A lot of PIC microcontrollers are designed with low power consumption, and therefore fits well in battery powered devices. **Wide Range of Models:** Its comes with different model having different	**High Performance:** ARM microcontrollers are well known for their high level processing performance and perfect for various demanding applications. **Energy Efficient:** ARM devices and particularly those devices that embrace the Cortex-M class are forged with an eye on delivering high performance while consuming the least amount of power as possible. **Rich Ecosystem:** ARM has substantial market shares with massive support from the industry hence

	memory, I/O options and peripherals in order to have the right model for use.	enhancing the development process.
Disadvantage	• **Limited Performance:** PIC microcontrollers are slow and less in power than ARM microcontrollers and hence are not so suitable for high performant applications. • **Complex Interrupt Handling:** Interrupt handling has been proved to be more complex as well as being less efficient in the case of PIC as compared with ARM. • **Limited Memory:** Compared to ARM, which is widely used, PIC usually provides less memory – this can become a problem in terms of the size of applications.	• **Cost:** ARM microcontrollers can be more expensive than PIC, especially when advanced peripherals are involved. • **Complex Architecture:** ARM architecture is more complex, which could result in a steeper learning curve for beginners. • **Higher Power Consumption in Some Cases:** While ARM is generally efficient, higher-end ARM processors can consume more power compared to low-end PIC microcontrollers in simple applications.