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HANDS ON ACTIVITY:
<u>EMBEDDED SYSYTEM COMPARISON 8051 AND ARDUINO</u>

| Feature | 8051 Micro-controller | Arduino |
|---|---|---|
| Architecture | Harvard | Modified Harvard |
| Instruction Set | 8-bit | 8-bit (AVR) or 32-bit (ARM) |
| Clock Speed | Typically up to 12 MHz | 8 MHz (Uno), 16 MHz (Mega), varies with different boards |
| Memory | ROM, RAM, EEPROM | Flash, SRAM, EEPROM |
| GPIO Pins | Limited | Abundant, typically 20 or more |
| Analog Inputs | Usually limited | Typically multiple, 6 or more |
| Digital I/O | Limited | Abundant |
| Development Tools | Limited availability | Extensive community support, IDE like Arduino IDE |
| Programming | Assembly, C | Arduino Sketch (C/C++) |
| IDE Support | Limited | Arduino IDE, PlatformIO |
| Debugging | Limited | Limited (Serial debugging, LED blinking) |
| Cost | Affordable | Affordable |

## To summarize:

**Architecture and Instruction Set**:

- The 8051 is an 8-bit microcontroller with a simple architecture and instruction set.
- Arduino boards typically use AVR or ARM-based microcontrollers, which have more advanced architectures and instruction sets compared to the 8051.

**Memory Organization**:

- The 8051 typically has limited on-chip memory for program storage and data storage.
- Arduino boards often have more memory available compared to the 8051, both in terms of program memory (flash) and data memory (RAM).

**Peripheral Integration**:

- The 8051 usually requires external components for additional functionality such as timers, UART, and I/O ports.
- Arduino boards often integrate many peripherals on the board itself, such as UART, SPI, I2C, digital I/O pins, analog inputs, PWM channels, etc., making it easier to interface with external devices.

**Development Environment**:

- Programming the 8051 microcontroller typically involves using specific IDEs and compilers provided by the manufacturer, such as Keil or SDCC.
- Arduino provides a user-friendly development environment based on the Arduino IDE, which abstracts away much of the low-level details and simplifies the programming process. It also offers a vast library of pre-written functions for various tasks.

**Interrupt Handling**:

- Both the 8051 and Arduino support interrupts for handling asynchronous events.
- Arduino abstracts away much of the complexity of interrupt handling, making it easier for beginners to work with interrupts.

**Power Consumption**:

- The 8051 is known for its low power consumption, making it suitable for battery-powered applications.
- Arduino boards vary in power consumption depending on the specific microcontroller used and the peripherals connected to it.

**Performance**:

- The performance of the 8051 is modest and suitable for many embedded applications but may not be suitable for high-performance computing tasks.
- Arduino boards typically have better performance compared to the 8051, especially if they use ARM-based microcontrollers. This allows for more complex tasks and faster execution of code.