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Architecture, Components and real-world applications of Arduino



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Introduction to Arduino

- Arduino is an open-source hardware and software company, project and user community that designs and manufacture single-board microcontrollers and microcontroller kits for building digital devices.
- It is an open-source electronics prototyping platform based on easy-to-use hardware and software.
- Arduino is written in C++ with some additional of specific methods and functions.
- Arduino is simple a programmable microcontroller. It does not have RTOS when compared to other computer systems.
- There are variety of Arduino boards such as Arduino UNO, Arduino Nano, Arduino Mega, e.t.c



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Arduino UNO board





Arduino Architecture

- Simply, Arduino's processor uses the Harvard architecture where the program code and program data have separate memory.
- It consists of two memory namely Program memory and Data memory.
- The code is stored in the flash memory, whereas the data is stored in the data memory.
- The Harvard architecture allows more than one memory transaction simultaneously through the use of two memory spaces.



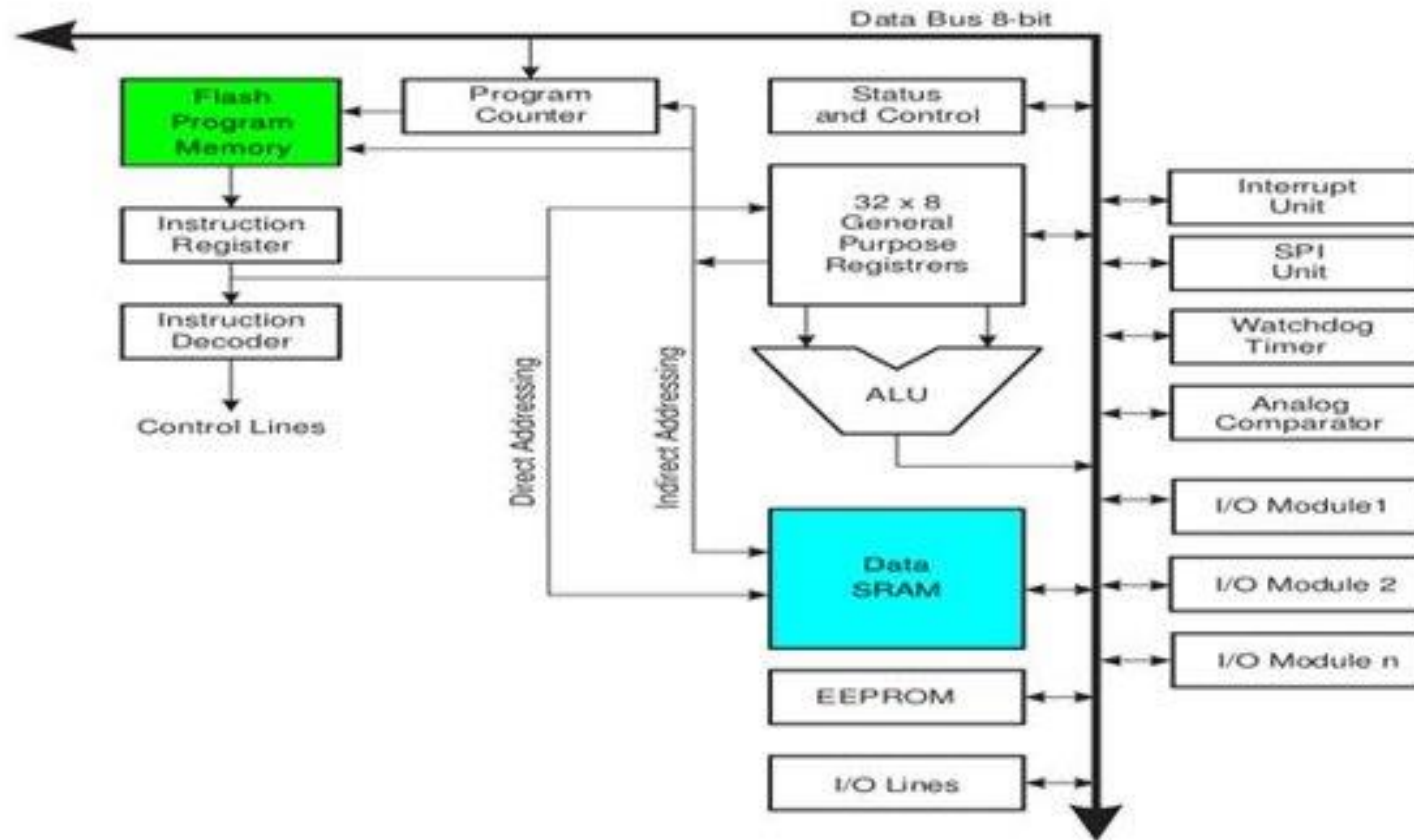
Arduino Architecture Cont ...

- In the Harvard architecture the un-occupied data memory cannot be used by instructions and the free instructions cannot be used by data.
- Memory dedicated to each unit has to be balanced carefully.
- Harvard architecture is primarily for small embedded systems and signal processing.
- A Harvard architecture system can be thus faster for a given circuit complexity because instruction fetches and data access do not contend for a single memory pathway.
- Also the Harvard architecture has distinct code and data address spaces meaning address zero is not the same as data address zero.



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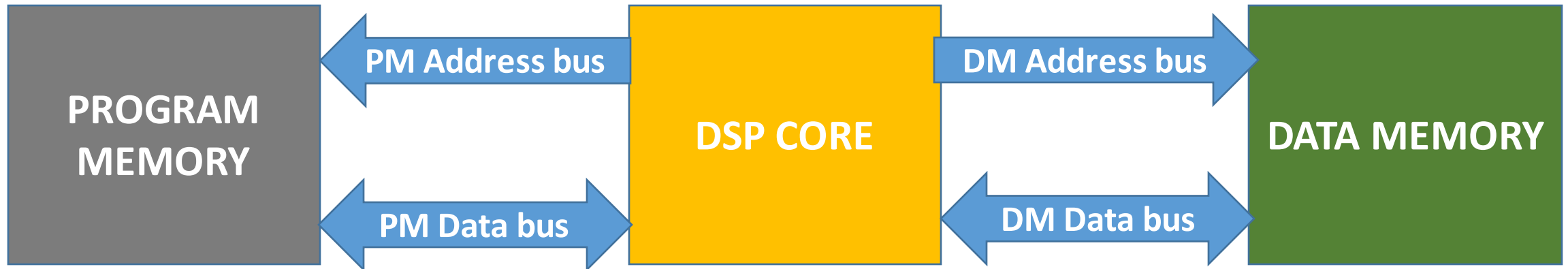
Harvard Architecture





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Harvard Architecture block diagram





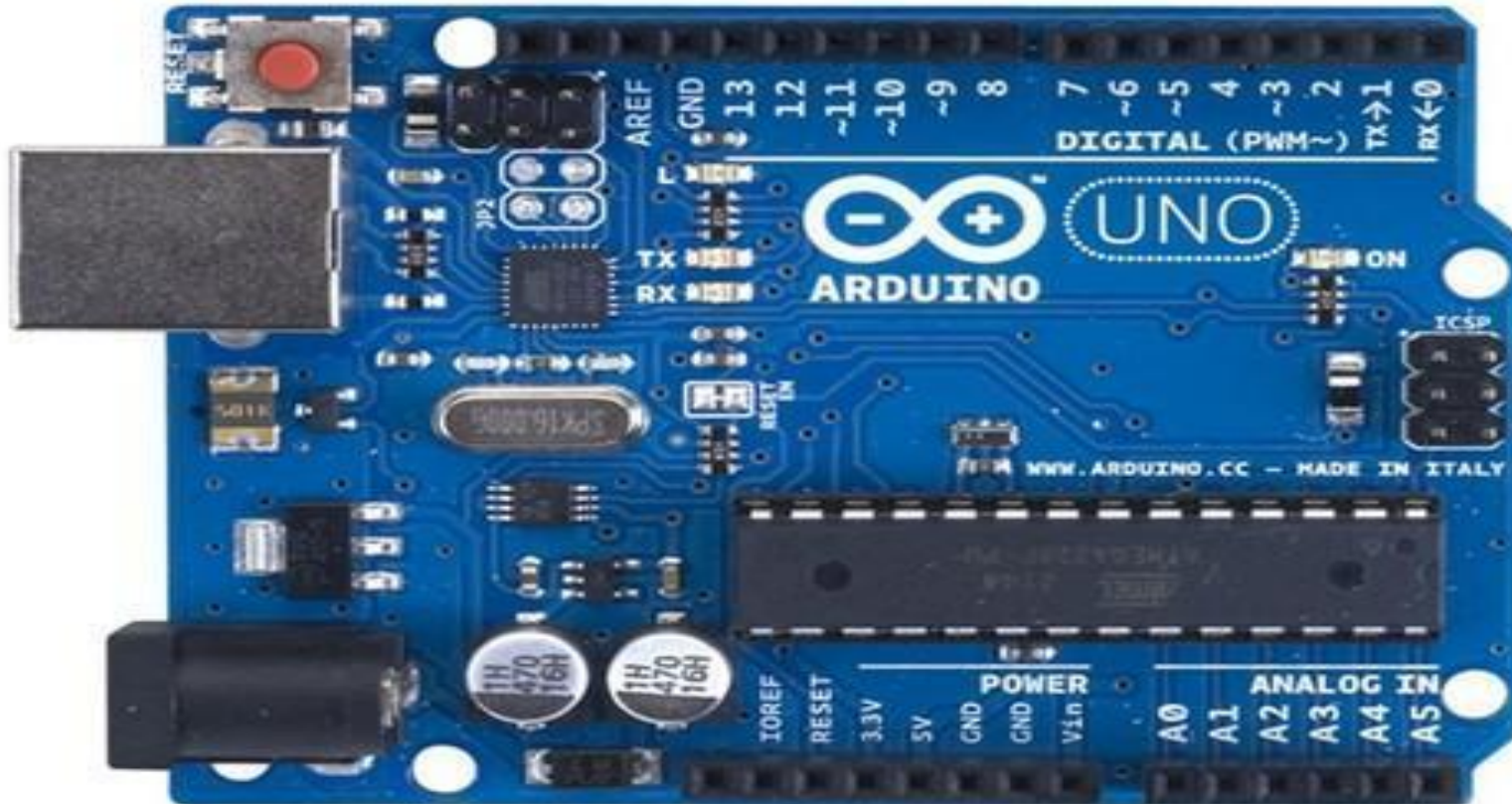
Arduino Components

- The major components of Arduino UNO board are as follows:
 - i. USB Connector
 - ii. Power port
 - iii. Microcontroller
 - iv. Analog input and Digital pins
 - v. Reset switch
 - vi. Crystal oscillator
 - vii. USB interface chip
 - viii. TX RX LEDs



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Arduino Components





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Real-world Applications of Arduino

- With the Arduino board we can control the Home, Office and Industrial activities with the control systems such as motion sensors, outlet control, temperature sensors, blower control, garage door control, air flow control and many others.
- Arduino can be used in many industrial control and automation systems.
- Using different top technologies like AI, ML, IoT and many others, we can interface an Arduino board to produce more and more intelligent devices and systems.
- Arduino is an open-source, it is just an electronics prototyping board.



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Must-have Tools

- Simulation software (e.g Proteus, Fritzing)
- Circuit designing tools (e.g Fritzing, Proteus, LibrePCB)
- Arduino IDE (very important)
- Arduino Kit



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Simulation of Arduino Projects

- A number of tools are used to simulate Arduino circuits
- Proteus Profession configured with Arduino Libraries
- Licensed Fritzing
- Online tools such as Tinkercad from <https://www.tinkercad.com>
- Blinking an LED.



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A handwritten note on a piece of aged, yellowish paper. It features a simple smiley face drawn above the words 'Thank you!', which are written in a cursive script and underlined with a single stroke. A period follows the exclamation mark.

Thank you!