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Arduino Mega



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What is an Arduino Mega?

- The Arduino Mega is a microcontroller development board designed for hobbyists and novices
- It has a custom coding interface (IDE) for creating, uploading, and troubleshooting code
- Multiple online tutorials are available for complex code and advanced development

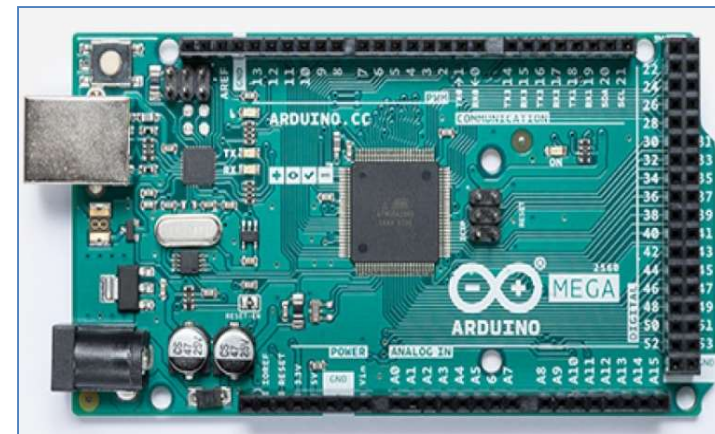


Figure 1: Arduino Mega Development Board



What is a microcontroller?

- A microcontroller (MCU) is an integrated circuit that acts as a tiny computer
- It contains a processor that can send and receive input, memory to store information, and programmable input and output (I/O) pins for working with external devices such as sensors and switches



Figure 2: ATmega2560 microchip



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What is a development board?

- Commercially available printed circuit board (PCB) designed to make it easier to interface with a microcontroller
- Provides minimum hardware for connecting external devices such as a USB adaptor and integrated circuits for voltage regulation
- Provides basic logic for programming and interacting with the device
- Useful for small project design and development



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Arduino Development Boards

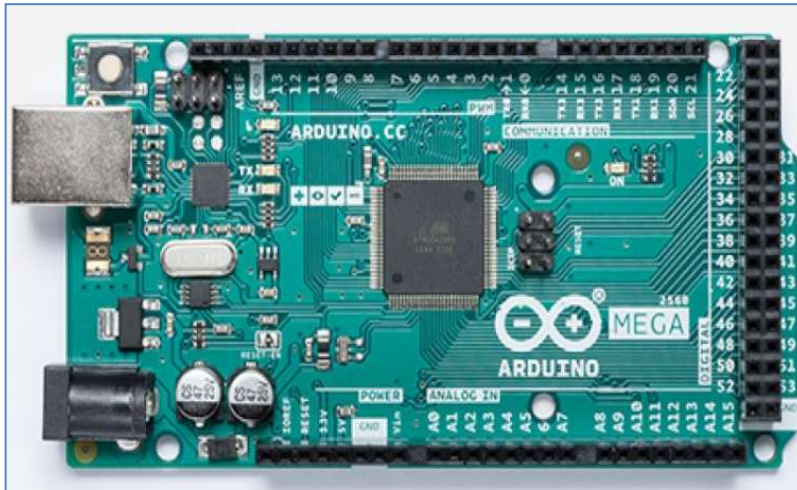


Figure 3: Arduino Mega microcontroller



Figure 5: Arduino Teensy microcontroller

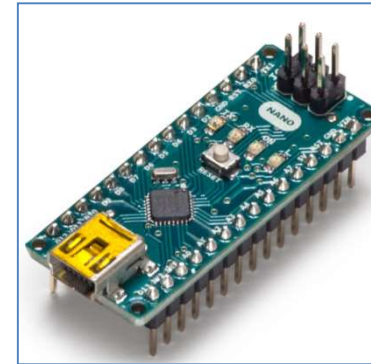


Figure 4: Arduino Nano microcontroller

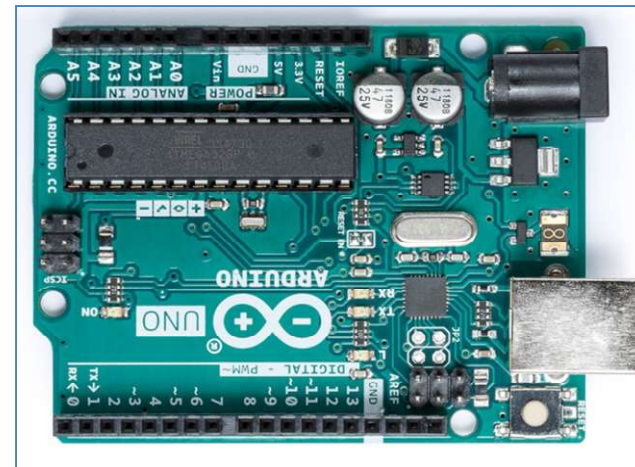


Figure 6: Arduino Uno microcontroller



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Other Development Boards

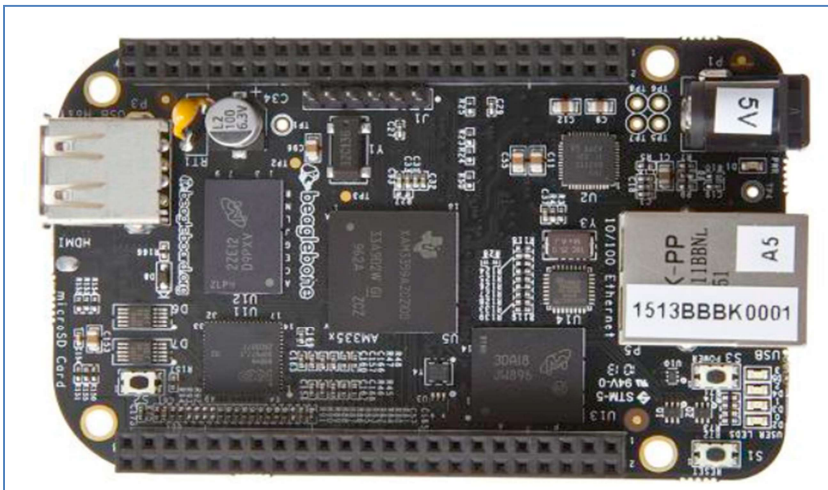


Figure 7: BeagleBone microcontroller



Figure 8: Raspberry Pi microcontroller

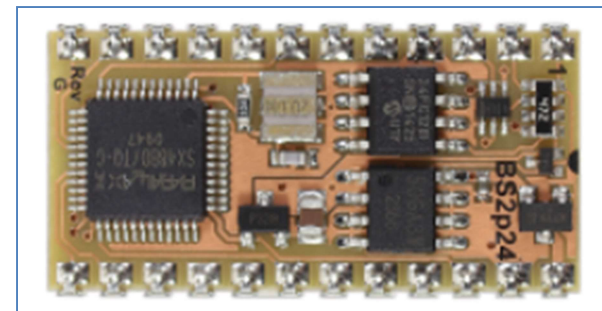


Figure 9: Basic Stamp microcontroller



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Arduino Mega Specifications

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16-channel 10-bit
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	13
Length	101.52 mm
Width	53.3 mm
Weight	37 g
Operating Temperature	-40°C to 85°C

Figure 10: Arduino Mega specifications



Figure 11: Arduino Mega microcontroller



Powering the Arduino

- The Mega can be powered via USB, battery or AC-to-DC wall adapter
- Recommended supply of 7-12 VDC
- Pin specific:
 - VIN: Provides power via an external supply
 - 5V: Provides a steady 5V supply through the voltage regulator
 - 3V3: Supplies 3.3 V with a maximum current draw of 50 mA
 - All of the I/O pins operate at 5 V and can provide or receive 20 mA (maximum 40 mA)

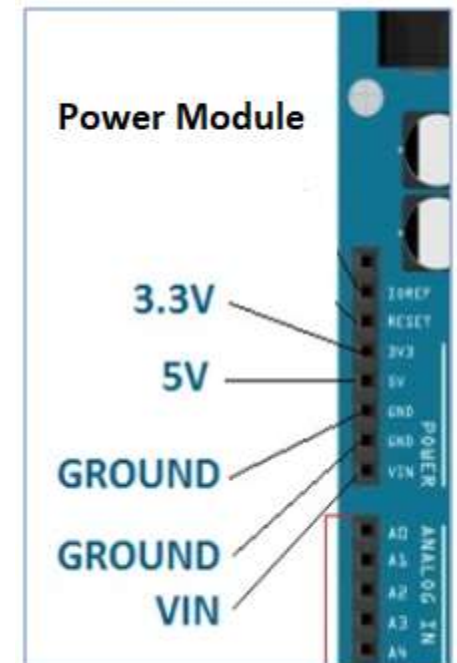


Figure 12: Arduino Mega power module



Memory

- The Mega offers 256 kB of self-programmable flash memory for storing code, with 8 kB dedicated to the bootloader
- It provides 8 kB of static random-access memory (SRAM) for storing variables
- There are 4 kB of electrically erasable programmable read-only memory (EEPROM) that can be used to read or write using the EEPROM library



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Interfacing with the Arduino

- Communication with the Mega is achieved using stackable header pins that connect to the internal circuitry of the board.
- Header Pins provide easy access to:
 - Power Inputs/Outputs
 - Analog-to-Digital (ADC) Channels
 - Digital I/O Pins
 - Serial Channels

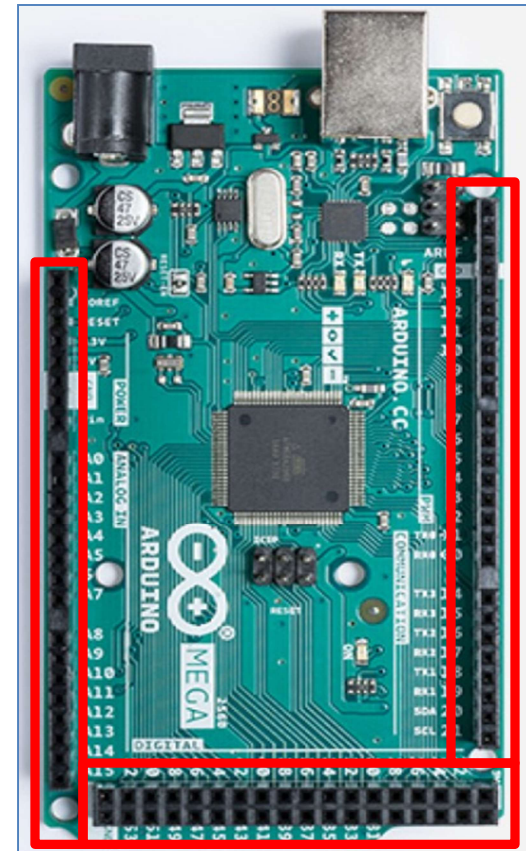


Figure 13: Arduino Mega microcontroller



ADC Channels

- The Mega provides sixteen 5V ADC channels for collecting information from external devices
- Each of the channels can interpret most electric signals below 5V into a digital number called an ADC value
- These values can be saved to variables on the Mega's onboard memory

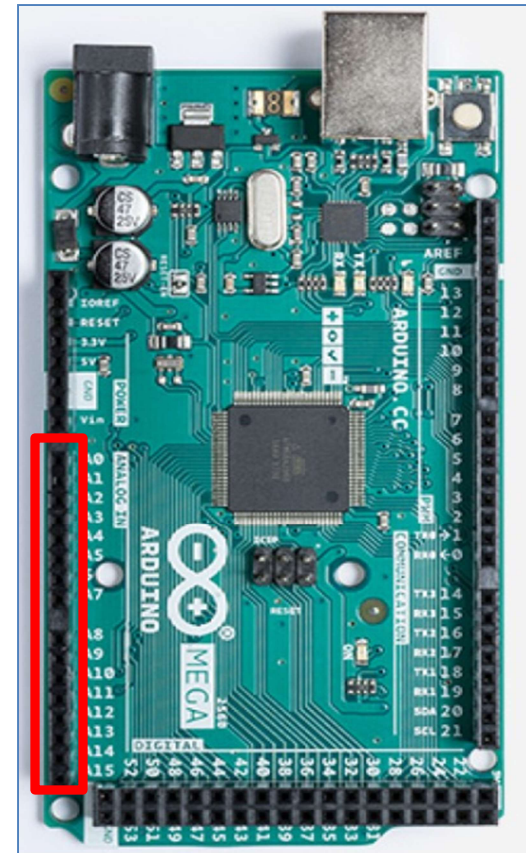


Figure 14: Arduino Mega microcontroller



Digital Input/Output

- The Mega provides 54 digital input/output (I/O) channels
- These allow for digital communication with external devices such as LEDs or switches
- Some channels have dedicated functions such as serial communication, pulse-width modulation (PWM) output, and interrupts

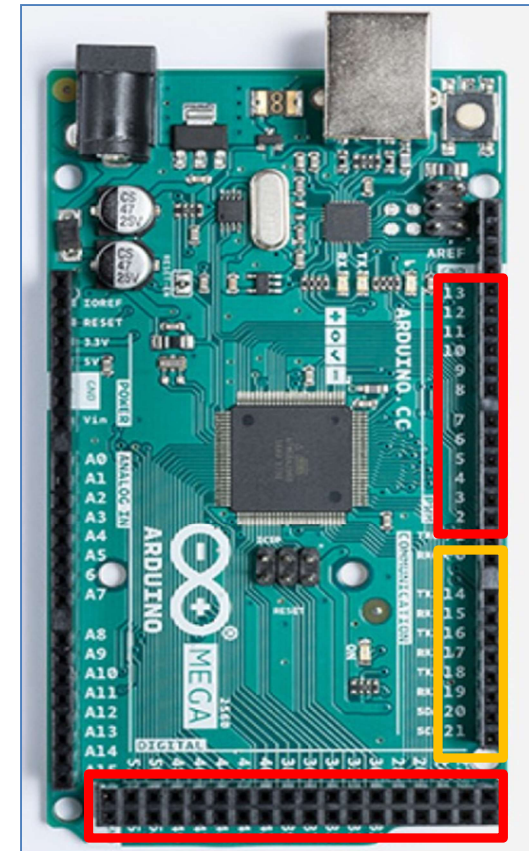


Figure 15: Arduino Mega microcontroller



More Digital I/O Features

- For hardware serial (UART), there are 4 pairs of RX and TX pins to receive and transmit TTL serial data
- SPI is available for MISO, MOSI, SCK and CS using the SPI library
- TWI for SDA and SCL is available using the Wire library with a 5V I²C bus on pins 20 and 21
- The Mega includes 15 PWM pins which provide an 8-bit output using the `analogWrite()` function



Arduino Shields

- Shields are modular circuit boards designed to piggyback onto the Arduino in order to increase functionality of the microcontroller
- The MegaSat was designed as a shield to attach directly to the Arduino Mega

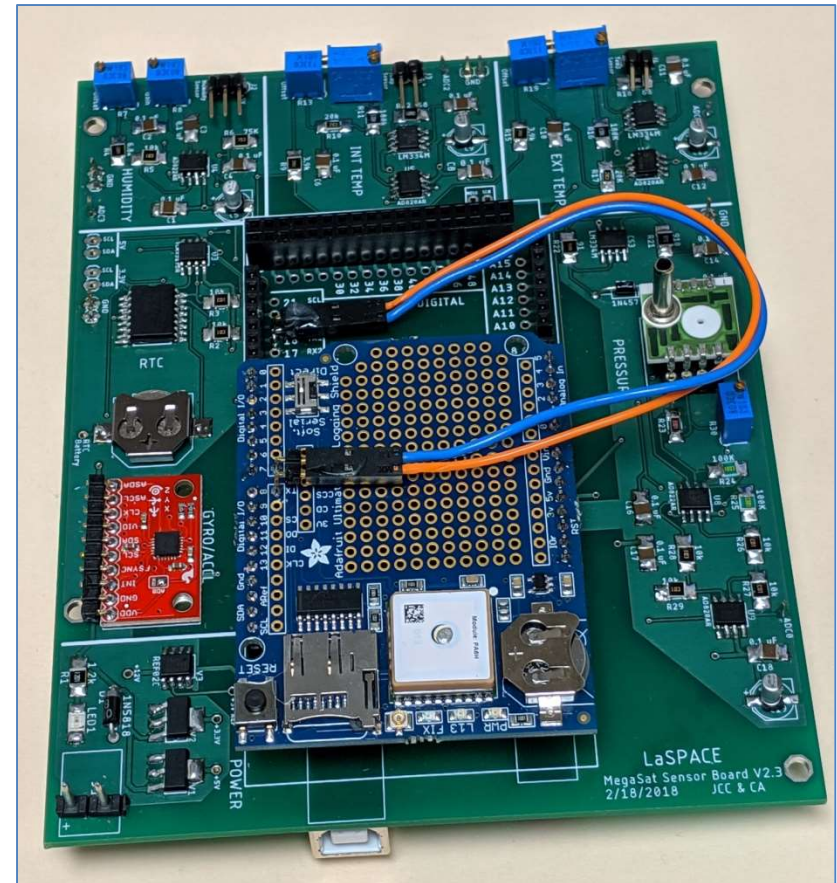


Figure 16: MegaSat prototype shield connected to an Arduino Mega



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Prototyping with Arduino

- Arduino Playground is a great place to start
 - Sample code
 - Project ideas
 - Community forums to share and explore
- Visit <https://playground.arduino.cc/>



Troubleshooting

- Power
 - Supplying less than 7 V may cause the 5 V pins to drop too low which can create instability
 - Supplying over 12 V may damage the voltage regulator and cause the circuit to overheat
- Connections
 - Refer to datasheets to ensure proper wiring
- Programming
 - Ensure correct libraries, keywords, pin selection, syntax (more details provided in coding lecture)



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