

## ARDUINO

Arduino boards come in various types, such as the

**Uno, Nano, Mega, and Due**, each with different microcontrollers and form factors. The classic **Arduino Uno** architecture centers on the ATmega328P microcontroller and features digital and analog pins, memory, a crystal oscillator, and communication interfaces.

### Types of Arduino Boards

Arduino offers a wide range of boards tailored for different project requirements, from basic prototyping to advanced IoT applications.

- **Arduino Uno (R3, R4):** The most popular and widely used board, ideal for beginners due to its simplicity, extensive documentation, and robust design.
- **Arduino Nano:** A smaller, breadboard-friendly version of the Uno, suitable for compact projects.
- **Arduino Mega (R3):** Features a larger number of I/O pins and more memory, making it ideal for complex projects requiring many sensors and actuators, such as 3D printers and robotics.
- **Arduino Leonardo:** Differs from the Uno as its microcontroller has built-in USB communication, allowing it to emulate a keyboard or mouse.
- **Arduino Due:** The first Arduino board based on an ARM Cortex-M3 core microcontroller (32-bit), offering higher performance and more advanced features than the AVR-based boards.
- **Arduino Micro:** A small board similar to the Nano but with the Leonardo's ability to act as a USB Human Interface Device (HID).
- **Specialized Boards:** Other types include the LilyPad (wearable electronics), Esplora (gamepad-style), and various IoT-focused boards like the Uno WiFi Rev2 and MKR series, which integrate connectivity options like Wi-Fi and Bluetooth.

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Arduino Uno



Arduino LilyPad



Arduino Mega 2560



Arduino Leonardo



Arduino Mega ADK



Arduino Ethernet



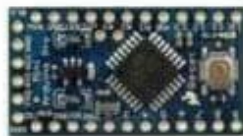
Arduino Pro



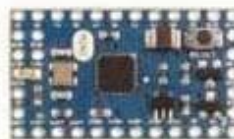
Arduino Nano



Arduino BT



Arduino Pro Mini



Arduino Mini



Arduino Fio

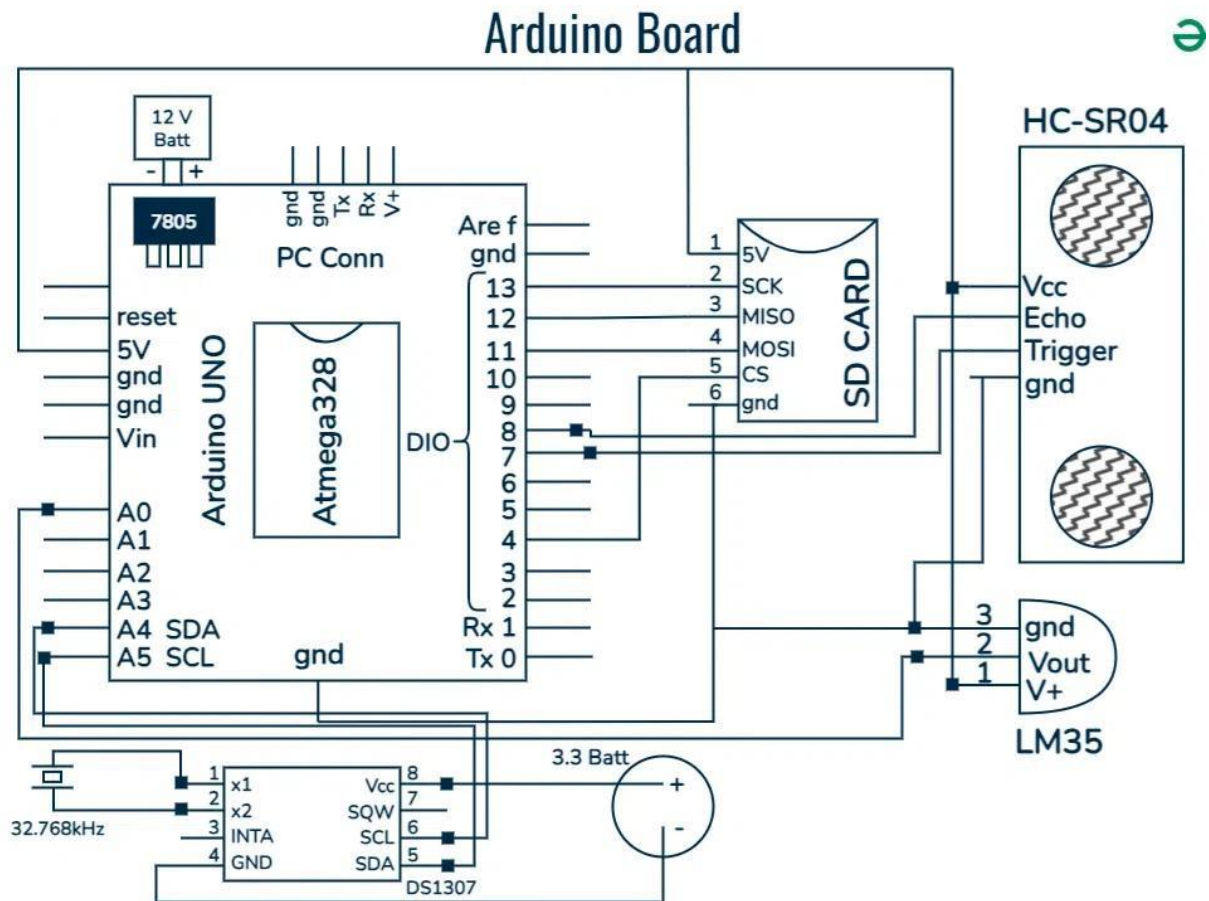
## Arduino Uno Architecture

The classic Arduino Uno (Rev3) is an open-source physical computing platform with a straightforward architecture designed for ease of use. Its key components and pin functions are:

- **Microcontroller:** The **ATmega328P** is the "brain" of the board, an 8-bit AVR RISC processor that executes the uploaded program (sketch).
- **Memory:**
  - **Flash Memory (32 KB):** Used for storing the program code, with 0.5 KB reserved for the bootloader.
  - **SRAM (2 KB):** Used for dynamic data during program execution (volatile memory).

- **EEPROM (1 KB):** Used for storing data that must persist even when the board is powered off (non-volatile memory).

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- **Input/Output (I/O) Pins:**

- **Digital I/O Pins (14):** Configurable as either input or output, operating at 5V. Six of these can provide Pulse Width Modulation (PWM) output (pins 3, 5, 6, 9, 10, 11) for analog-like control.
- **Analog Input Pins (6):** Labeled A0 through A5, these pins read continuous analog values (e.g., from sensors) and convert them into a digital value (10-bit resolution).

- **Communication Interfaces:**

- **Serial (UART):** Pins 0 (RX) and 1 (TX) are used for receiving and transmitting serial data. An onboard ATmega16U2 chip acts as a USB-

to-serial converter, allowing communication with a computer over USB.

- **SPI:** Supported on pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK) for high-speed data transfer.
- **I<sup>2</sup>C (TWI):** Supported on analog pins A4 (SDA) and A5 (SCL) for multi-device communication using only two wires.
- **Power Circuitry:** The board can be powered via a USB connection or an external power supply (7-12V recommended range) through a power jack or the Vin pin. A voltage regulator ensures stable 5V operation for the microcontroller.
- **Crystal Oscillator:** A 16 MHz crystal oscillator provides the clock signal for the ATmega328P, ensuring precise timing for all operations.
- **Reset Button:** A physical button allows the user to restart the program currently running on the board.

