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Arduino Environment: Extending Functionality through Libraries The Arduino environment is divided into three main parts: structure, values (variables and constants), and functions. To fully utilize this platform, it's essential to understand how to install libraries and harness their functionality. ##### Serial Communication Serial communication is a crucial aspect of the Arduino environment. It can be used inside if statements and is also used for communication between the board and other devices via USB. The Arduino Mega features three additional serial ports: Serial1, Serial2, and Serial3, which can be connected to external TTL devices or personal computers using an USB-to-serial adaptor. ##### Library Installation and Use Libraries are a key component of extending the Arduino environment's functionality. They provide extra capabilities for use in sketches, such as working with hardware or manipulating data. To use a library in a sketch, select it from Sketch > Import Library. A variety of libraries come pre-installed with the IDE, but users can also download or create their own. ##### Key Considerations When utilizing serial communication and libraries, it's essential to note that pins 0 and 1 are reserved for digital input/output purposes and cannot be used simultaneously. The Arduino environment also features a built-in serial monitor that can be accessed by clicking the serial monitor button in the toolbar. Installing libraries is a crucial step in any Arduino project. There's also a tutorial on writing your own custom libraries, which can be found alongside this article. For best practices in creating a good API for your library, refer to the official Arduino Style Guide. Here are some of the most common types of libraries: * Robotics Libraries: These include Servo and Stepper libraries for controlling servo and stepper motors. + Servo: For controlling servo motors + Stepper: For controlling stepper motors * Communication Libraries: These enable communication protocols such as SPI, I2C, UART, and more. + SPI: For communicating with devices using the Serial Peripheral Interface (SPI) Bus + Wire: Two Wire Interface (TWI/I2C) for sending and receiving data over a network of devices or sensors + SoftwareSerial: For serial communication on any digital pins * Connectivity Libraries: These allow you to access radio modules on different IoT boards, including Wi-Fi, Bluetooth, LoRa, GSM, NB-IoT, and Sigfox. + ArduinoIoTCloud: Connects to the Arduino IoT Cloud service + ArduinoBLE: For using Bluetooth Low Energy on select boards + Ethernet: For connecting to the Internet via Ethernet + GSM: For connecting to a GSM/GPRS network with the GSM shield + MKRWAN: Library for the MKR WAN 1300/1310, for connecting to LoRaWAN networks + MKRGSM: Library for the MKR GSM 1400, for connecting to GSM/GPRS networks + MKRNB: Library for the MKR NB 1500, for connecting to NB-IoT / Cat M1 networks + SigFox: Library for the MKR FOX 1200, for connecting to the Sigfox network + WiFi: For the Wi-Fi shield and Internet connections via Wi-Fi + WiFi101: Library for the MKR 1000 Wi-Fi and WiFi101 shield, for Internet connections via Wi-Fi + WiFININA: Library for boards with a Wi-Fi NINA module, for Internet connections via Wi-Fi * Nano Family Libraries: Designed specifically for embedded sensors on various Nano boards. + ArduinoAPDS9960: Library to use the gesture sensor APDS9960; it senses gestures, colors, ambience illumination, and proximity + Arduino.LSM6DS3: Library to use the LSM6DS3 6-axis IMU available on the Arduino Nano 33 IoT and the Arduino UNO WiFi Rev. 2 + Arduino.LSM9DS1: Library to use the LSM9DS1 9-axis IMU available on the Arduino Nano 33 BLE and the Arduino Nano 33 BLE Sense + Arduino.LSM6DSOX: Library to use LSM6DSOX 6-axis IMU available on the Arduino Nano RP2040 Connect + ArduinoLPS22HB: Library to use the barometer and temperature sensor LPS22; it is an ultra-compact sensor that functions as a digital output barometer + ArduinoHTS221: Library to use the HTS221 relative humidity & temperature sensor + PDM: Library to use the digital microphone MP34DT05 (Nano BLE Sense and Nano RP2040 Connect) * Memory Libraries: For memory management and data storage. + EEPROM: Reading and writing to "permanent" storage + SD: For reading and writing SD cards * Display Libraries: For controlling different displays. + LiquidCrystal: For controlling liquid crystal displays (LCDs) + TFT: For drawing text, images, and shapes on the Arduino TFT screen The MKR boards come equipped with various libraries to enhance functionality. These include the Real Time Clock for scheduling events, as well as library-specific shields such as ArduinoMKRGPS and ArduinoRS485. Additionally, there are graphics and RS485-related libraries like ArduinoGraphics and ArduinoRS485. For audio capabilities, libraries like AudioZero and ArduinoSound allow for simple playback and analysis of audio data. The I2S protocol is also supported through the I2S library on SAMD21 boards. In terms of USB functionality, libraries such as USBHost and Keyboard enable communication with peripherals or an attached computer. Other notable libraries include Firmata for serial communication and CurieBLE for interacting with smartphones and tablets via Bluetooth Low Energy. Retired products have their corresponding libraries archived under the 'Retired Libraries' section. The Arduino programming language consists of three main components: functions, values (variables and constants), and structure.

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