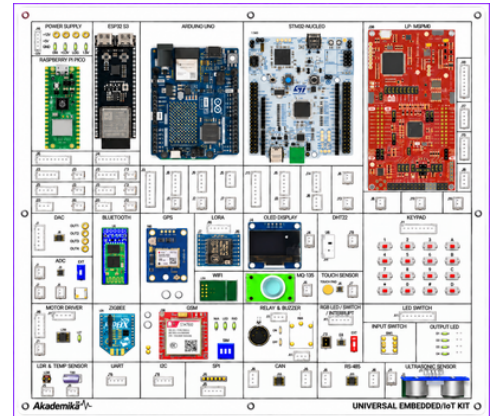


PL-UNIVERSAL

Universal Embedded Trainer Kit with Arduino, Raspberry Pi, ESP32, STM32 and MSP Microcontrollers



FEATURES

- The Universal Embedded Board is a single training and development platform that brings together five popular microcontroller families — Arduino UNO, ESP32, Nucleo-G431RB, Raspberry Pi Pico w2, and MSPM0G3507 — on one carrier board. It integrates 20+ ready-to-use sections covering sensors, displays, actuators, analog interfaces, and both wired (UART, I2C, SPI, CAN) and wireless (Wi-Fi, Bluetooth, ZigBee, GSM, GPS) communication modules. This lets students and developers learn the same embedded concept across different controller architectures without rewiring hardware for each one. From basic GPIO experiments to advanced IoT and multi-controller applications, it's built for structured teaching labs, workshops, and rapid prototyping alike
- One Carrier Board – Five Development Platforms – Multiple Programming Environments
- The Universal Embedded MCU/MPU Trainer is designed around a common carrier board that supports five different development platforms. This allows students to perform the same embedded-system and IoT experiments using different microcontroller architectures, programming tools and software environments.
- The platform helps users understand how a common hardware application can be implemented using different controllers while keeping the sensors, communication interfaces and peripheral modules on the carrier board unchanged.
- The trainer platform supports five different development boards, allowing users to learn and compare different microcontroller architectures, programming languages, development tools and coding methods on a common carrier board.
- Multi-Platform Programming Concept A single experiment can be developed independently on different controllers.

SPECIFICATIONS

Microcontroller Specifications

ARDUINO Development Modules

- 48 MHz Arm® Cortex®-M4 microprocessor with a floating point unit (FPU)
- 256 kB Flash Memory
- 32 kB SRAM
- 8 kB Data Memory (EEPROM)
- 5 V operating voltage



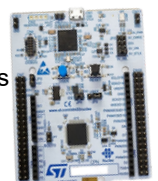
ESP32 Development Modules

- Processor: 32-bit Xtensa LX7 Dual-Core, Up to 240MHz
- Wireless Connectivity: Wi-Fi IEEE 802.11 b/g/n 2.4GHz + Bluetooth 5 (BLE)
- Flash Memory: 8MB Quad SPI Flash
- PSRAM: 8MB Octal SPI PSRAM
- Module: ESP32-S3-WROOM-1U-N8R8
- Power Supply: 5V DC



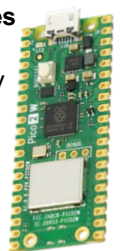
STM32 Development Modules

- STM32G431RB Cortex-M4F @ 170 MHz
- 128 KB Flash, ~32 KB total SRAM resources
- High-performance ADCs
- UART, SPI, I2C, CAN-FD
- FPU + DSP instructions
- STM32 CUBE MX & STM32 CUBE IDE



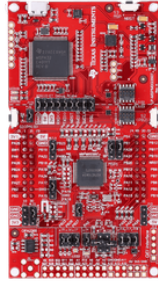
RASPBERRY PI PICO 2 W Development Modules

- Microcontroller: RP2350
- Dual ARM Cortex-M33 or Dual Hazard3 RISC-V
- Clock Speed: 150 MHz
- Memory: 520 KB SRAM, 4 MB QSPI Flash
- Wireless: Onboard 2.4 GHz Wi-Fi
- Bluetooth 5.2 / BLE
- Peripherals: 12 Programmable I/O (PIO)
- Thonny



LP- MSP Development Modules

- ARM Cortex-M0+ @ 80 MHz
- 128 KB Flash, 32 KB SRAM
- Up to 60 GPIO,
- 4xUART, 2xSPI, 2xI2C, CAN-FD
- 2x12-bit 4-MSPS ADC, 12-bit DAC
- 2xOp-Amps + 3xComparators
- DMA, AES, CRC, TRNG
- Code composer studio



WIRELESS Specifications

- Bluetooth : Provides short-range wireless communication with mobile phones, PCs, and other devices.
- Zigbee : Provides low-power wireless communication for sensor networks and automation systems.
- GSM : Provides cellular communication for SMS, calls, data transfer, and remote monitoring.
- Wifi : Provides wireless network and Internet connectivity for IoT and data communication.
- GPS : To read data from a GPS receiver
- LORA : Provides long-range, low-power wireless communication for remote sensor and IoT applications.

Carrier Board Specifications

- DAC (DAC124S085C1MM_NOPB) : Resolution: 12-bit, Channels: 4-channel quad DAC
- ADC(ADS7946SRTER) : Resolution: 14-bit, Channels: 2-channel, 10K POT
- DRV8833PWPR (motor driver) : H-Bridges: 2, Output Current: 1.5A
- LDR & LM35 : Type: Light Dependent Resistor (LDR)
Type: Precision Centigrade Temperature Sensor (LM35)
- CAN (SN65HVD230DR) :Data Rate: 1 Mbps, Supply Voltage: 3.3 V
- RS-485(SP3485CN): Data Rate: 10 Mbps, Supply Voltage: 3.3 V
- Relay: 5V Coil, 10A Switching Capacity
- Buzzer: 5V Operating Voltage
- RGB led : Configuration: Common Cathode, Package: 5mm Diffused
- Temperature Sensor : Temp Range: -40°C to 80°C , Humidity Range: 0-100% RH
- 4 dip switch,
- 4 output led
- Keypad(switch) 4x4, Layout: 4x4 Matrix, 16Keys
- Mux-demux for : uart selection
- Power Supply : 12V , 5V

Extra Communication Buses (Port) Specifications

- I2C
- SPI
- UART
- CAN Transceiver: SN65HVD230DR compatible CAN bus transceiver with built-in ESD protection.

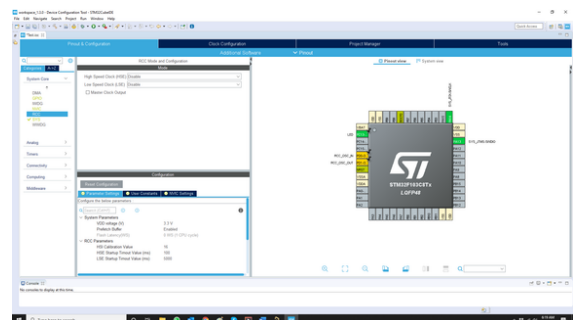
- RS485 Transceiver : MODUBUS Implementation.
- Sensor Support
- ADC Sensor
- Wire Sensor
- PWM Sensor
- GPIO Sensor

SOFTWARE

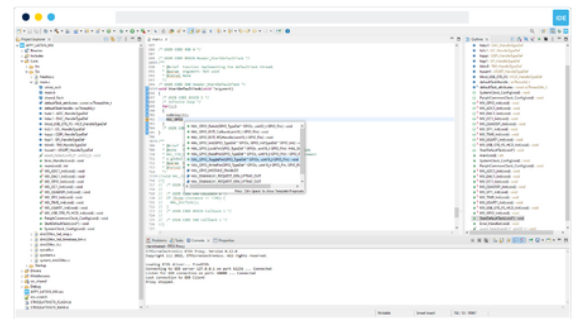
- **ARDUINO IDE** : ARDUINO IDE the official, open-source software used to write, compile, and upload code



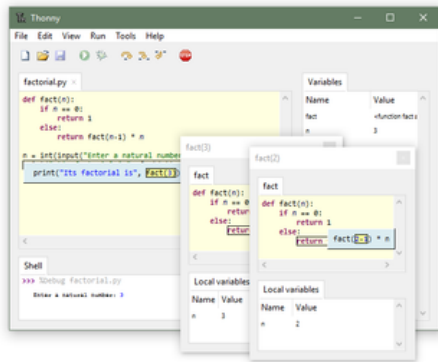
- **STM32 CUBE MX** : A visual configuration tool. It helps you design your project before you start writing code.



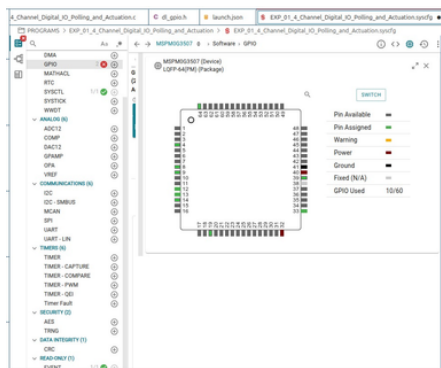
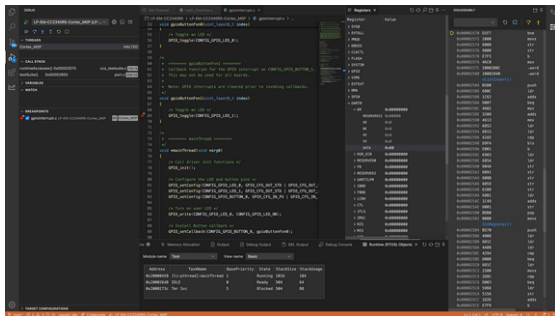
- **STM32 CUBE IDE** : A complete C/C++ development environment for STM32 microcontrollers.



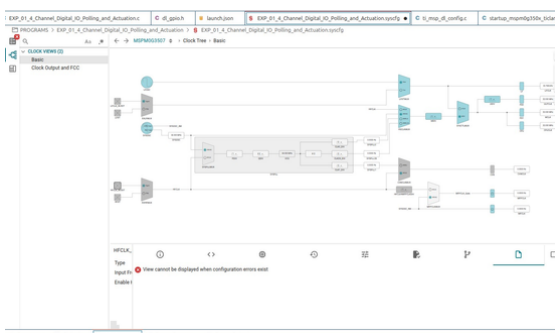
- **Thonny** : lightweight Python IDE designed specifically for beginners and physical computing.



- **Code composer studio** : Code Composer Studio is a highly professional, industrial-grade IDE based on the Eclipse framework. It is used exclusively for Texas Instruments (TI) embedded processors.



launchpad MSP430 system configuration ui



launchpad MSP430 clock configuration

EXPERIMENTS

- GPIO & LED Control — Digital I/O, timing, & switch control. Module: GPIO
- Keypad + OLED Interface — Matrix scanning & embedded UI. Module: Keypad, OLED
- Push-Button & Interrupts — External interrupts & debouncing. Module: Push-button
- ADC & Potentiometer — Analog acquisition & scaling. Module: ADC, POT
- DAC Waveform Gen. — Analog waveform generation. Module: DAC
- Temperature sensor — Temp & humidity acquisition. Module: Temperature sensor
- Gas Sensor — Gas sensing & threshold alerts. Module: Gas Sensor
- LDR Light Sensing — Light intensity measurement. Module: LDR
- Temp Sensor Logging — Ambient temperature logging. Module: Temp Sensor
- Ultrasonic Distance — Distance calculation & alarms. Module: Ultrasonic
- RGB LED Color Control — PWM color mixing & effects. Module: RGB LED
- Buzzer Alert System — Tone generation & event alerts. Module: Buzzer
- Relay Load Switching — External AC/DC load switching. Module: Relay
- DC Motor Control — PWM speed & direction control. Module: Motor Driver
- Stepper Motor Control — Step sequencing & direction. Module: Motor Driver
- UART Communication — Serial data exchange (PC/Module). Module: UART
- I2C Communication — I2C peripheral interfacing. Module: I2C
- SPI Communication — SPI peripheral interfacing. Module: SPI
- CAN Node Comm. — CAN frame & multi-node comms. Module: CAN (ESP32, Nucleo, MSP430 only supported)
- RS485 MODBUS Implementation.
- Bluetooth Data — Wireless serial link. Module: Bluetooth
- ZigBee Mesh Comm. — Short-range wireless networking. Module: ZigBee
- GSM Interface — AT-command cellular control. Module: GSM
- GPS Data Reception — NMEA reception & parsing. Module: GPS
- Wi-Fi IoT Monitoring — Network-connected sensor logging. Module: Wi-Fi
- LORA : Provides long-range, low-power wireless communication for remote sensor and IoT applications.