

I2C

I2C is often used for serial communication. It consists of two pins, SDA (Serial Data) and SCL (Serial Clock). Both pins are connected to ground through pull-down resistors. The SCL pin is also connected to the VDD pin of the I2C device. The SDA pin is connected to the VDD pin of the I2C device.

UART

UART (Universal Asynchronous Receiver Transmitter) is a serial communication interface. It consists of four pins: TX (Transmit), RX (Receive), GND (Ground), and VCC (Power). The TX pin is connected to the VCC pin of the UART device. The RX pin is connected to the GND pin of the UART device. The GND pin is also connected to the VCC pin of the microcontroller. The VCC pin is connected to the power source.



Timers

Timing Functions: Timers provide precise timing functions, allowing for accurate measurement and control of time intervals.
 - Timer 1: 16-bit timer
 - Timer 2: 16-bit timer
 - PWM Generation
 - Event Counting
 - Pulse Width Trimming
 - Motor Range 0 to 100
 - Motor Range 20 to 100
 - Motor Range 0 to 1000
 - Digital Range: Channel 75-78 to open IO5-IO2



Timer Settings

• Prescaler: The prescaler divides the clock source to the timer by a factor of 1, 2, or 4.
 • Counter Mode: The counter mode increments the timer value every time an event occurs.
 • Edge Selection: An external signal can trigger the counter to start from zero.
 • Timer Output: The timer output is a digital signal that can be used to control other components.
 • Clock Source: The timer source is selected from the system clock or an external clock source.

Bluetooth Module

A Bluetooth module is a hardware component that enables wireless communication between a microcontroller and a mobile device. It uses the Bluetooth Low Energy (BLE) protocol to connect to a smartphone or tablet. The module has a built-in antenna and a small PCB with various components. It is typically used for remote control applications or data transmission over short distances.

USART

• Serial Port: The USART module is used for serial data exchange.
 • Baud Rate: The baud rate is the speed at which data is transmitted.
 • Data Bits: The data bits are the number of bits used to represent each character.
 • Stop Bits: The stop bits are the number of bits used to indicate the end of a character.
 • Parity Bit: The parity bit is used to detect errors in the transmitted data.
 • Handshaking: Handshaking is used to synchronize data transfer between two devices.



1. Servo Motors

- A servo motor is a type of rotary actuator or motor that is designed to provide precise control of angular or linear position.
 - Feedback System:
 - Controller
 - Closed-Loop Control
 - High Precision



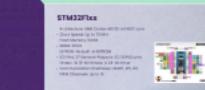
4 DOF Robotic Manipulator for Pick'n'Place

Ahmed Mady

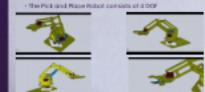
Robotics Corner

Outline

- Introduction
- Embedded C++
- Servo & Timers
- Bluetooth Module & USART
- GPIO & I2C

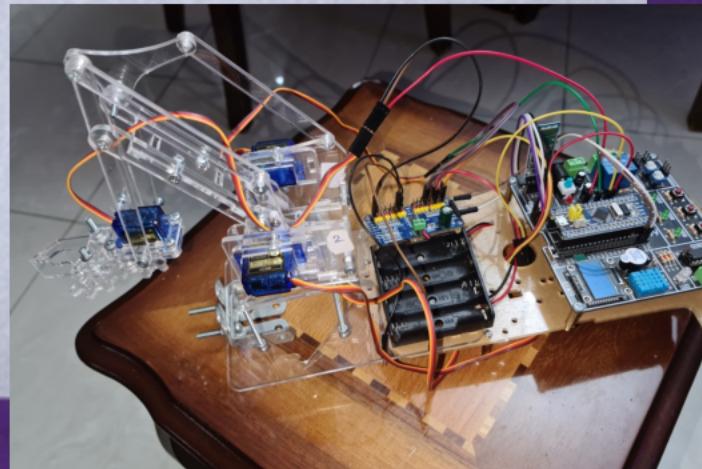


Introduction



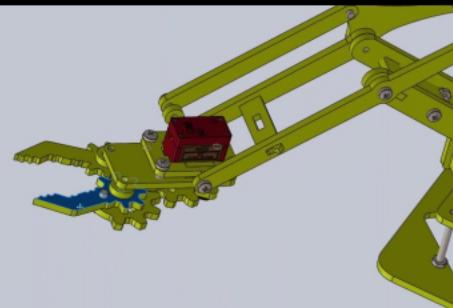
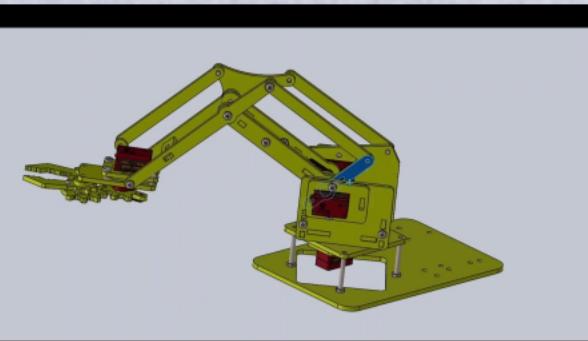
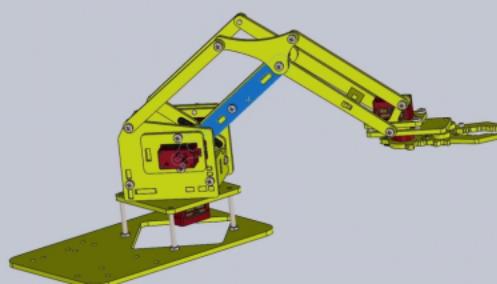
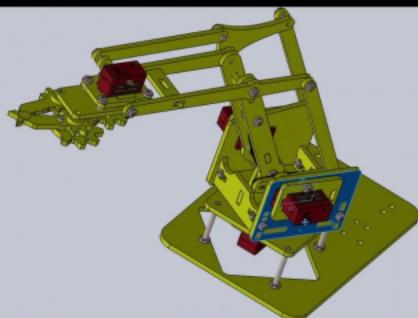
Outline

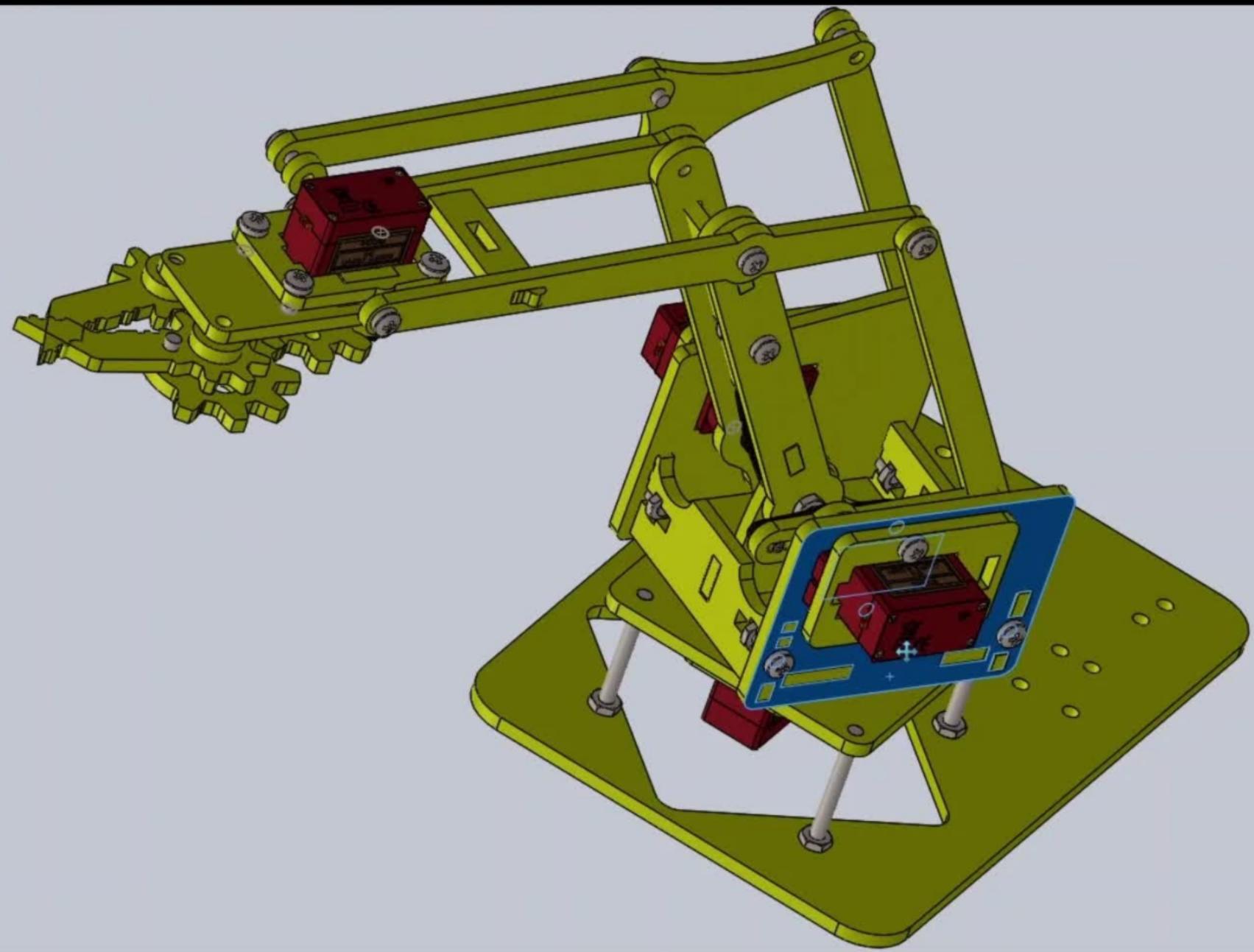
- Introduction
- Embedded C++
- Servo & Timers
- Bluetooth Module & USART
- OLED & I2C

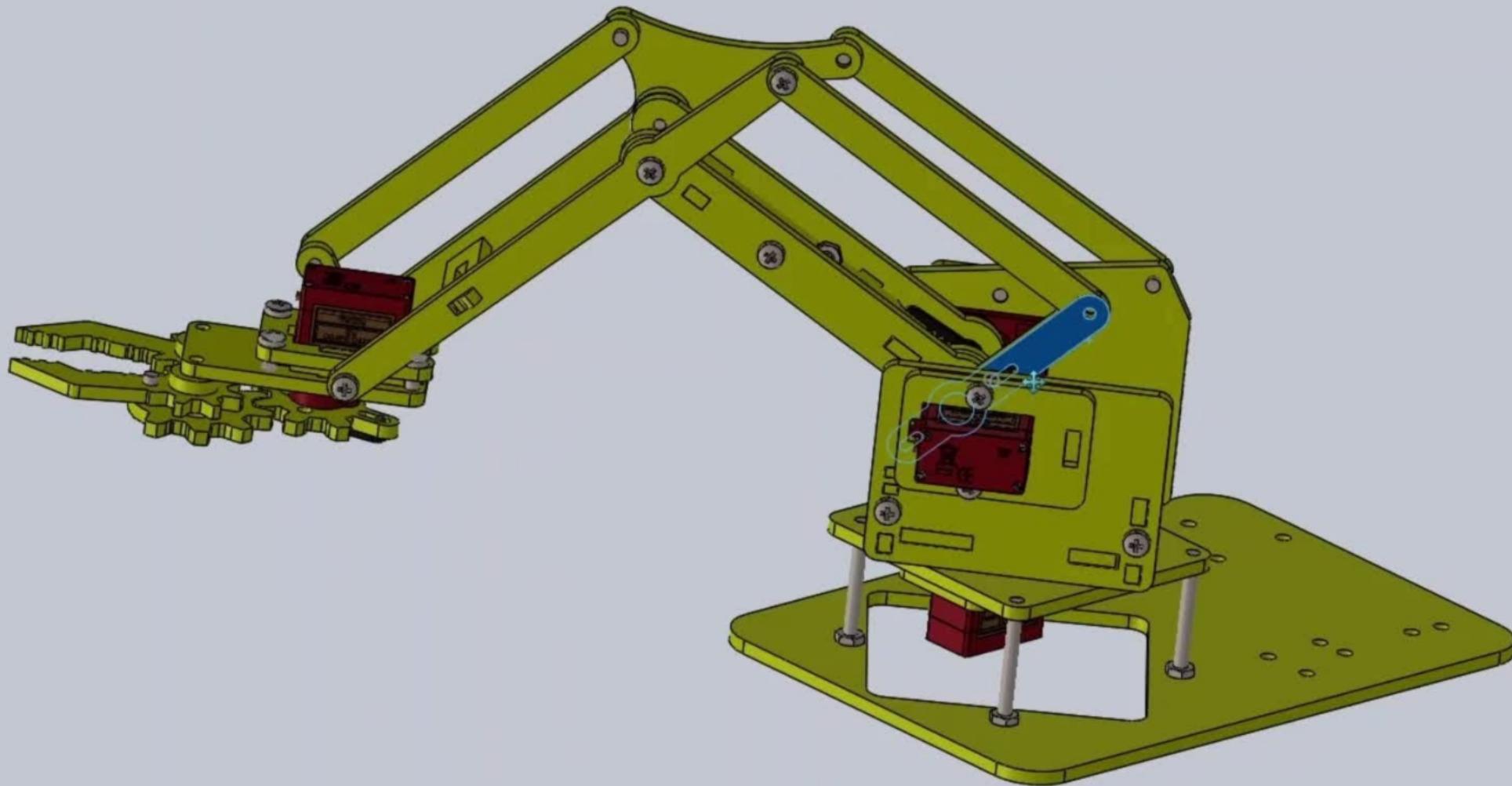


Introduction

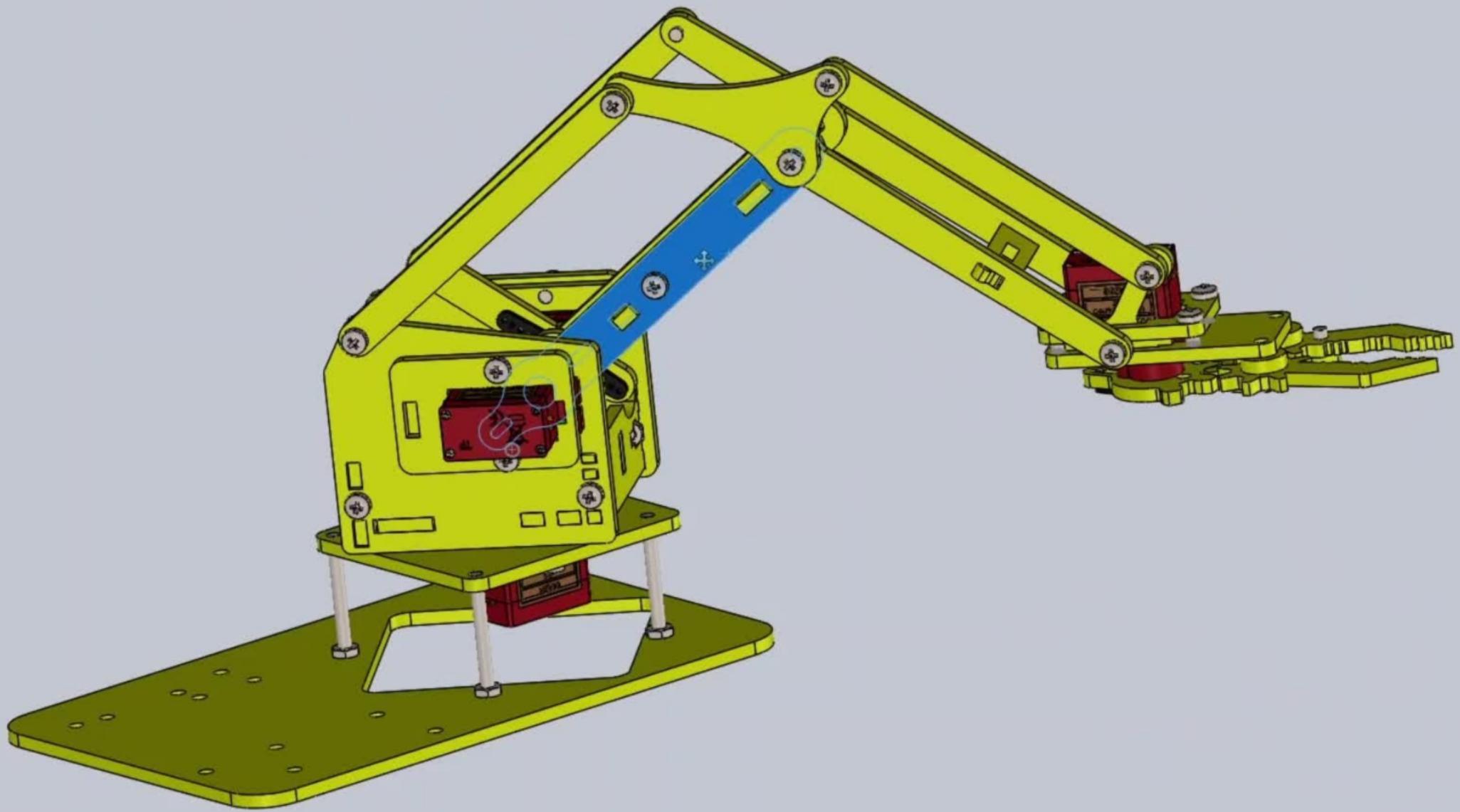
- The Pick and Place Robot consists of 4 DOF

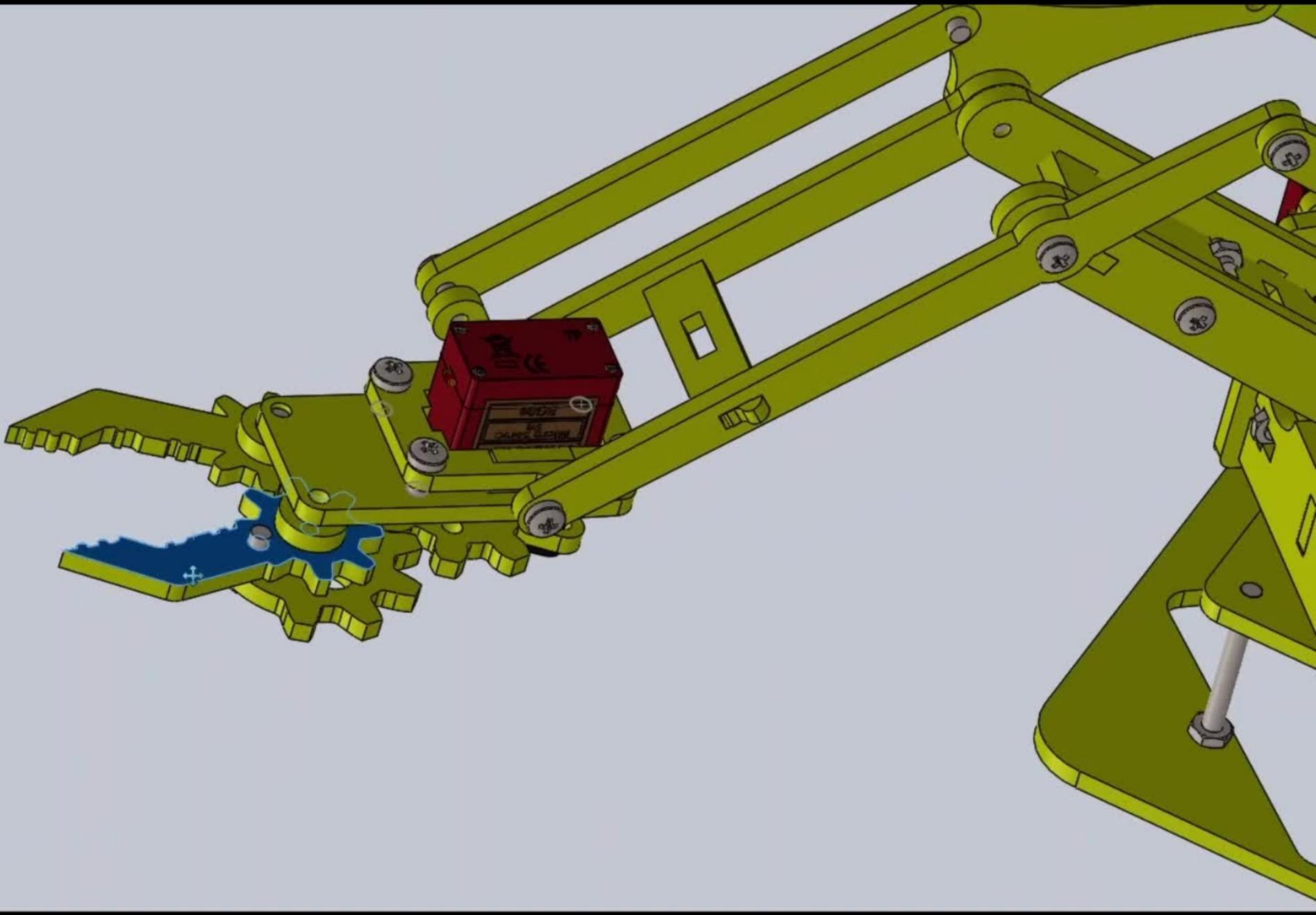






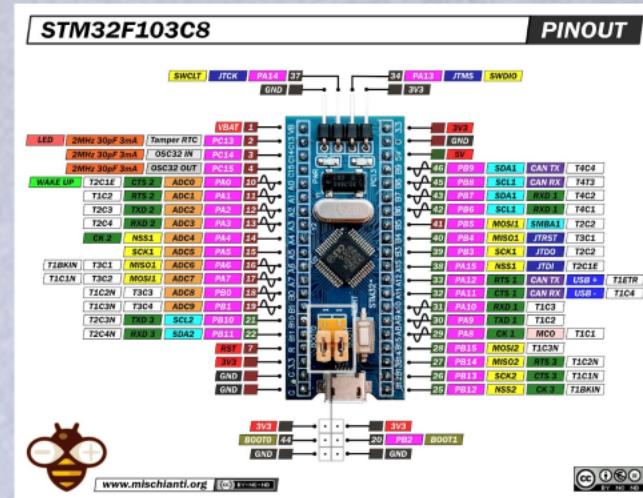
z
y
x





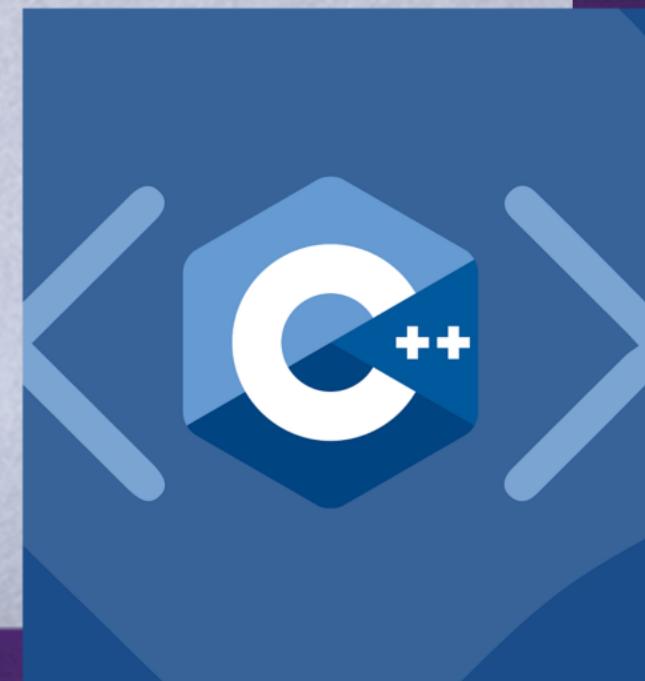
STM32F1xx

- Architecture: ARM Cortex-M3 32-bit RISC core
 - Clock Speed: Up to 72 MHz
 - Flash Memory: 64 KB
 - SRAM: 20 KB
 - EEPROM: No built-in EEPROM
 - I/O Pins: 37 General-Purpose I/O (GPIO) pins
 - Timers: 3x 16-bit timers, 1x 24-bit timer
 - Communication Interfaces: USART, SPI, I2C
 - PWM Channels: Up to 15



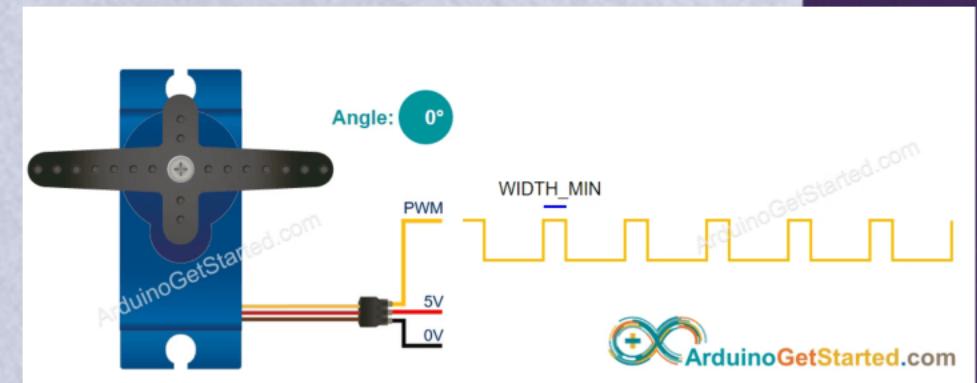
Why Embedded C++?

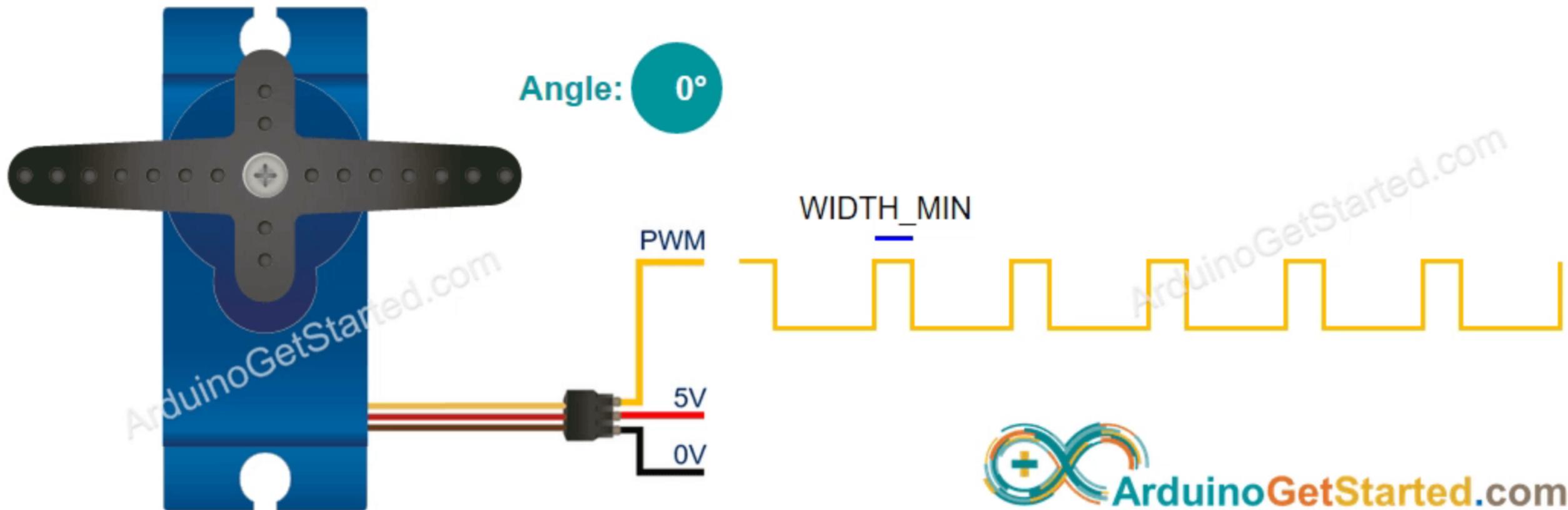
- OOP for encapsulation, inheritance, and polymorphism
- Abstraction and Modularity



1. Servo Motors

- A servo motor is a type of rotary actuator or motor that is designed to provide precise control of angular or linear position.
- Feedback System
- Controller
- Closed-Loop Control
- High Precision



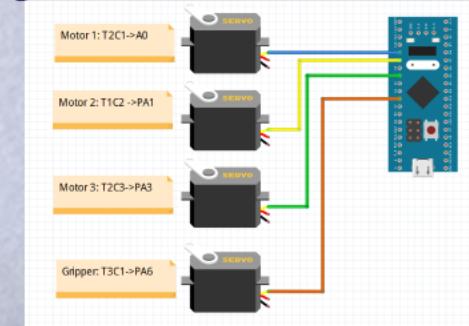


ArduinoGetStarted.com

Timers

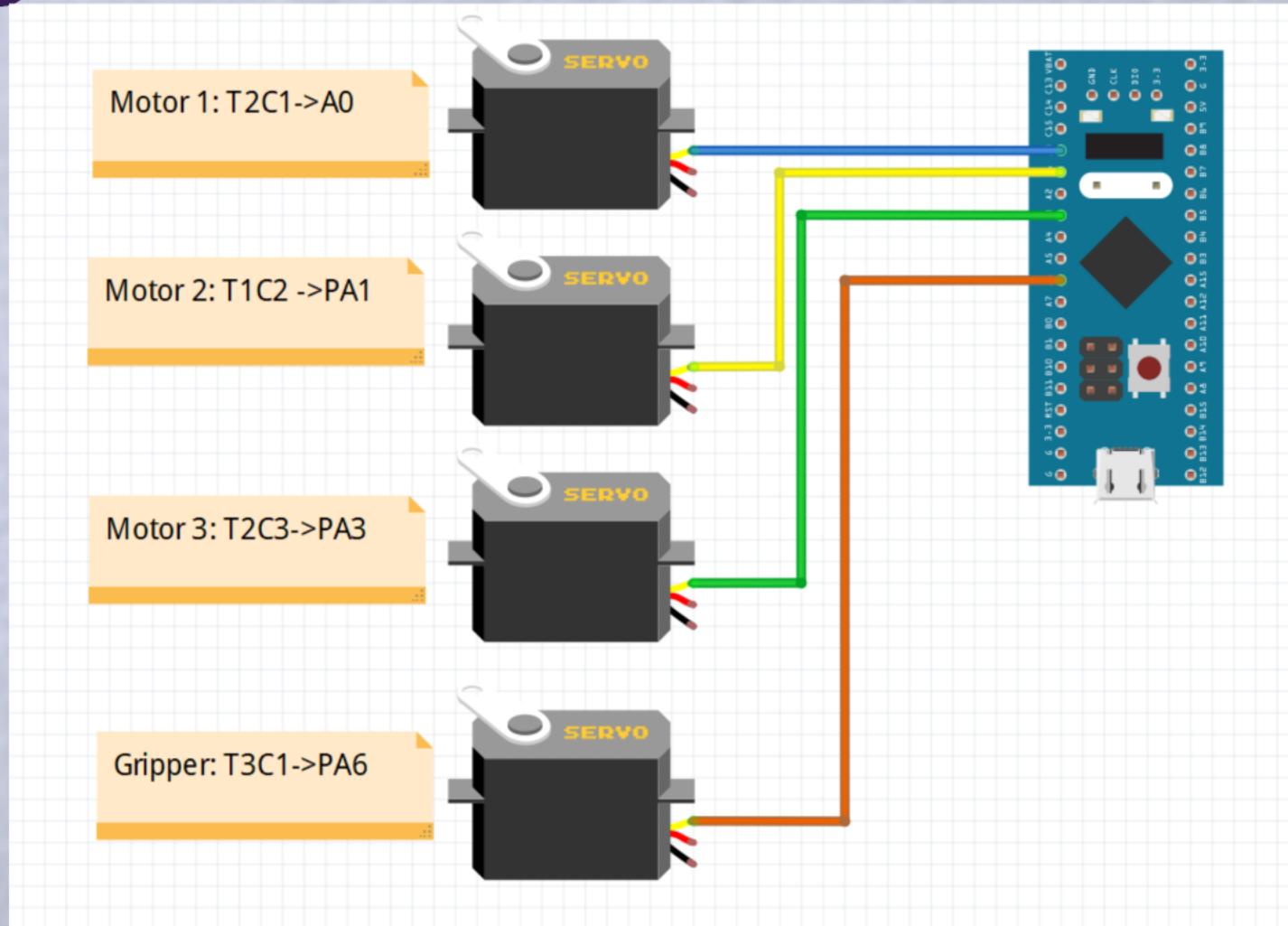
- Timing Functions: Timers provide precise timing functions, allowing for accurate measurement and control of time intervals.
- Interrupt Generation
- PWM Generation
- Event Counting
- Time-Based Triggering
- Motor 1 Range: 0 to 180
- Motor 2 Range: 20 to 170
- Motor 3 Range: 30 to 150
- Gripper Range: Closed: 70-75 to Open: 105-110

Wiring



Wiring

105-110



Timer Settings

- Prescaler: The prescaler is set to 15. This means the timer will count at 1/16th of the frequency of the peripheral clock.
- Counter Mode: TIM_COUNTERMODE_UP.
- Period: The period is set to 9999. When the counter reaches this value, it will overflow and generate an update event. This determines the time it takes for the timer to reset.
- Clock Source: The clock source is set to TIM_CLOCKSOURCE_INTERNAL, indicating that the internal clock is used as the timer's clock source.

I2C

I2C is often used for serial communication. It consists of two pins: SDA (Serial Data) and SCL (Serial Clock). Both pins are connected to ground through pull-down resistors. The SCL pin is also connected to the VDD pin of the microcontroller. The SDA pin is connected to the I2C bus.

UART

UART (Universal Asynchronous Receiver Transmitter) is a serial communication interface. It consists of four pins: TXD (Transmit Data), RXD (Receive Data), GND (Ground), and VCC (Power). The TXD pin is connected to the microcontroller's serial output, and the RXD pin is connected to the microcontroller's serial input. The GND and VCC pins provide power and ground for the module.



Timers

Timing Functions: Timers provide precise timing functions, allowing for accurate measurement and control of time intervals.
 - Timer 1: 16-bit timer
 - PWM Generation
 - Event Counting
 - Pulse Width Trimming
 - Motor Range 0 to 100
 - Motor Range 20 to 100
 - Motor Range 70 to 100
 - Digital Range: Channel 75-78 to open IO5-IO2



Timer Settings

• Prescaler: The prescaler divides the clock source to the timer by a factor of 1, 2, 4, 8, 16, 32, 64, or 128.
 • Counter Mode: The counter mode of the timer increments the counter value every timer clock period.
 • Output Compare: An interrupt is generated when the timer reaches a specific value. This value can be set to a constant value or generated on a regular interval.
 • PWM: Pulse Width Modulation generates a square wave signal whose width is controlled by the timer value.
 • Dead-Bounce: This feature ensures that the digital output does not change state until the timer value has been updated.

Bluetooth Module

A Bluetooth module is a hardware component that enables wireless communication between a device and other devices. It uses radio waves to transmit data over short distances, typically up to 10 meters. The module can be used to connect a device to a computer or smartphone via a wireless network.

USART

• Serial Port: The USART module is used for serial data exchange.
 • Baud Rate: The baud rate is used to define the speed of data transmission.
 • Data Bits: The data bits are used to define the number of data bits transmitted per character.
 • Stop Bits: The stop bits are used to define the number of stop bits transmitted per character.
 • Parity: The parity bit is used to detect errors in the transmitted data.
 • Handshake: Handshake is a communication protocol that involves sending and receiving signals to coordinate data transfer between two devices.



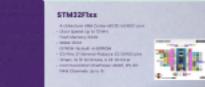
1. Servo Motors

- A servo motor is a type of rotary actuator or motor that is designed to provide precise control of angular or linear position.
 - Feedback System:
 - Controller
 - Closed-Loop Control
 - High Precision

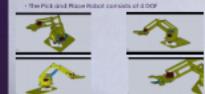


Outline

- Introduction
- Embedded C++
- Servo & Timers
- Bluetooth Module & USART
- Qwiic & I2C



Introduction



4 DOF Robotic Manipulator for Pick'n'Place

Ahmed Mady

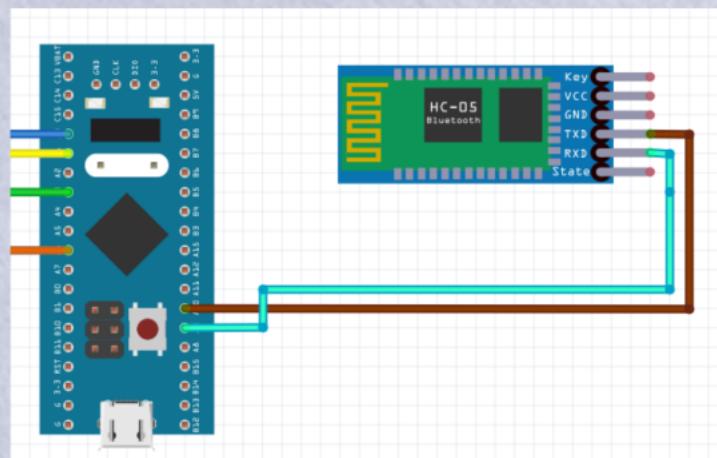
Robotics Corner

Bluetooth Module

- A Bluetooth module is a hardware component that enables wireless communication between electronic devices over short distances.
- Serial Communication: Many Bluetooth modules support serial communication protocols like UART (Universal Asynchronous Receiver-Transmitter).
- Mobile Data Sender: Bluetooth Electronics
- UART, which stands for Universal Asynchronous Receiver/Transmitter, is a communication protocol and hardware interface commonly used for serial communication between electronic devices.

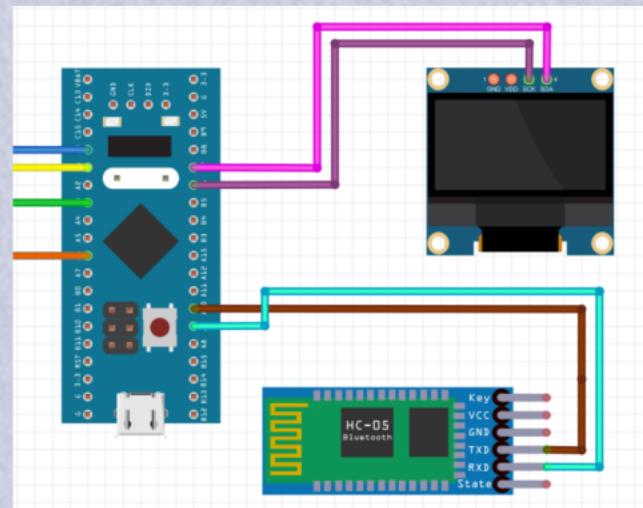
USART

- Baud Rate: The communication speed is set to 9600 bits per second.
 - Word Length: Each data frame consists of 8 bits.
 - Stop Bits: One stop bit is used to signal the end of a data frame.
 - Parity: No parity bit is used for error checking.
 - Mode: The USART is configured for both transmitting (TX) and receiving (RX) data concurrently, using `UART_MODE_TX_RX`.
 - Recieve Frame: Letter + number + Letter



OLED

- An OLED (Organic Light-Emitting Diode) is a type of display technology that uses organic compounds to emit light when an electric current is applied. OLED displays are known for their vibrant colors, high contrast ratios, wide viewing angles, and thin form factors.
- Uses I2C Communication, SSD1306



I2C

- I2C, which stands for Inter-Integrated Circuit, is a popular and widely used serial communication protocol that allows multiple devices to communicate with each other over a short distance.
- Settings: Clock Speed: The I2C bus clock speed is set to 400,000 Hz (or 400 kHz).
- Addressing Mode: The addressing mode is set to I2C_ADDRESSINGMODE_7BIT, indicating that 7-bit addressing mode is used.
- No-Stretch Mode: No-stretch mode is disabled (I2C_NOSTRETCH_DISABLE), indicating that the I2C clock stretching feature is enabled. Clock stretching allows the slave device to slow down the clock to process data.

