**CLIL PARTE 2
STEPPER MOTOR**

Read the attached code and then create the circuit capable of realizing it in the wokwi simulator.

*// test a stepper motor with a Pololu A4988 driver board or equivalent*

*// this version uses millis() to manage timing rather than delay()*

*// and the movement is determined by a pair of momentary push switches (push button)*

*// press one and it turns CW, press the other and it turns CCW*

byte directionPin = 9;

byte stepPin = 8;

byte buttonCWpin = 10;

byte buttonCCWpin = 11;

boolean buttonCWpressed = false;

boolean buttonCCWpressed = false;

byte ledPin = 13;

unsigned long curMillis;

unsigned long prevStepMillis = 0;

unsigned long millisBetweenSteps = 25; *// milliseconds*

void **setup**() {

     Serial.begin(9600);

     Serial.println("Starting Stepper Demo with millis()");

     pinMode(directionPin, OUTPUT);

     pinMode(stepPin, OUTPUT);

     pinMode(ledPin, OUTPUT);

     pinMode(buttonCWpin, INPUT\_PULLUP);

     pinMode(buttonCCWpin, INPUT\_PULLUP);

}

void **loop**() {

    curMillis = millis();

    readButtons();

    actOnButtons();

}

void **readButtons**() {

    buttonCCWpressed = false;

    buttonCWpressed = false;

    **if** (digitalRead(buttonCWpin) == LOW) {

        buttonCWpressed = true;

    }

    **if** (digitalRead(buttonCCWpin) == LOW) {

        buttonCCWpressed = true;

    }

}

void **actOnButtons**() {

    **if** (buttonCWpressed == true) {

        digitalWrite(directionPin, LOW);

        singleStep();

    }

    **if** (buttonCCWpressed == true) {

        digitalWrite(directionPin, HIGH);

        singleStep();

    }

}

void **singleStep**() {

    **if** (curMillis - prevStepMillis >= millisBetweenSteps) {

            *// next 2 lines changed 28 Nov 2018*

        *//prevStepMillis += millisBetweenSteps;*

        prevStepMillis = curMillis;

        digitalWrite(stepPin, HIGH);

        digitalWrite(stepPin, LOW);

    }

}

Add the WOKWY schema function in the box below and any explanations.

**Briefly answer the following questions**

1. What are the main parts of a stepper motor?
2. Why are powered stepper motors hot even if the shaft is not rotating?
3. What are the main differences between bipolar and unipolar steppers?
4. What type of stepper motor provides the most torque at the same speed?
5. What type of engine is the 28BYJ-48?
6. How much current does a small stepper motor typically consume?
7. What is the typical working voltage of stepper motors?
8. What is a "driver"?
9. What is meant by "microstepping"?
10. How do you choose a stepper motor?
11. What does the abbreviation NEMA 23 mean?
12. With a 1/16 microsteps what angular precision is obtained?
13. What is the maximum speed of a stepper motor?
14. What torque does a small NEMA 17 motor typically have?
15. What does the Arduino code in “sample 1” do?

**VIDEO ABOUT STEPPER MOTOR**

<https://howtomechatronics.com/tutorials/arduino/how-to-control-stepper-motor-with-a4988-driver-and-arduino/>

<https://howtomechatronics.com/tutorials/arduino/stepper-motors-and-arduino-the-ultimate-guide/>