#include "mbed.h"

#include "TextLCD.h"

#include <cstdio>

#include <new>

#include <vector>

// Host PC Communication channels

Serial pc(USBTX, USBRX); // tx, rx

// I2C Communication

I2C i2c\_lcd(I2C\_SDA, I2C\_SCL); // SDA, SCL >>> NUCLEO: D14,D15

//I2C Portexpander PCF8574

TextLCD\_I2C lcd(&i2c\_lcd, 0x7E, TextLCD::LCD20x4); // I2C bus, PCF8574 Slaveaddress, LCD Type Original = 0x42, Usando I2C scanner = 0x3F

//define quais portas serão usadas e o que farão

DigitalOut clk(PB\_15); //step

InterruptIn botao\_confirma(PA\_11); //botão confirma/verde

InterruptIn botao\_chega(PB\_6); //botão start cycle/vermelho

InterruptIn botao\_emergencia(PA\_10); //botão de emergencia

InterruptIn sensor\_x\_1(PC\_9); //sensor de fim de curso em x

DigitalIn x\_mais(PB\_4); //botão de x+

DigitalIn x\_menos(PB\_3); //botão de x-

DigitalOut enable\_x(PC\_5);//enable em x

DigitalOut clkwise\_x(PC\_6);//direção em x

InterruptIn sensor\_y\_1(PB\_7); //sensor de fim de curso em y

DigitalIn y\_mais(PB\_10);//botão de y+

DigitalIn y\_menos(PA\_8);//botão de y-

DigitalOut enable\_y(PB\_12);//enable em y

DigitalOut clkwise\_y(PB\_11);//direção em y

InterruptIn sensor\_z\_1(PA\_12); //sensor de fim de curso em y

DigitalIn z\_menos(PC\_7); //botão de z-

DigitalIn z\_mais(PA\_9);//botão de z+

DigitalOut enable\_z(PB\_13);//enable em z

DigitalOut clkwise\_z(PB\_14);//direção em z

DigitalOut pipeta(PC\_4); //pipeta

//Variaveis usadas

int tempo = 950;

int ola;

int quantos\_depositos;

int confirma1;

int pote;

int volume;

int index;

int referenciar;

int ciclo;

int fim\_referenciamento;

int fc;

int jog;

int ciclo\_emergencia;

int voltar\_origem;

int curso\_x = 49019;

int referenciar\_x;

int fonte\_x;

int deposito\_x=0;

int curso\_y=17220;

int referenciar\_y;

int fonte\_y;

int deposito\_y;

int curso\_z = 7450;

int referenciar\_z;

int fonte\_z;

int deposito\_z;

int n;

int define\_volume;

int define\_posicao;

int x1;

int x2;

int x3;

int y1;

int y2;

int y3;

int z1;

int z2;

int z3;

int v1;

int v2;

int v3;

int erro;

void vermelho(){ //Rotina de interrupção que inicializa o ciclo automatico (start cycle)

    if(index>1){

        ciclo=9;

    }

}

void emergencia(){ //Rotina de interrupção da emergencia

    erro=!erro;

    if(erro==0){

        NVIC\_SystemReset(); //reseta o programa

    }

}

void fim\_de\_curso\_z\_1(){  //Rotina de interrupção do fim de curso em z

    switch (fc) {

        case 0:

            referenciar=2;

            clkwise\_z=0;

            for(int i=0;i<400;i++){

                enable\_z=0;

                clk=!clk;

                wait\_us(tempo);

            }

            fc++;

            enable\_z=1;

            break;

    }

     switch (ciclo) {

        case 0:

            enable\_x=1;

            enable\_y=1;

            enable\_z=0;

            for(int i=0;i<400;i++){

                clkwise\_z=1;

                clk=!clk;

                wait\_us(tempo);

            }

            break;

    }

}

void fim\_de\_curso\_y\_1(){  //Rotina de interrupção do fim de curso em y

    switch (fc) {

        case 1:

            referenciar=3;

            clkwise\_y=0;

            for(int i=0;i<400;i++){

                clk=!clk;

                wait\_us(tempo);

            }

            fc++;

            enable\_y=1;

            break;

        }

     switch (ciclo) {

        case 0:

            enable\_y=0;

            enable\_x=1;

            clkwise\_y=1;

            for(int i=0;i<400;i++){

                clkwise\_y=0;

                clk=!clk;

                wait\_us(tempo);

            }

            break;

        }

}

void fim\_de\_curso\_x\_1(){   //Rotina de interrupção do fim de curso em x

    switch (fc) {

        case 2:

            referenciar=4;

            clkwise\_x=1;

            for(int i=0;i<400;i++){

                enable\_x=0;

                clk=!clk;

                wait\_us(tempo);

            }

            fc++;

            fim\_referenciamento=1;

            enable\_x=1;

            break;

    }

     switch (ciclo) {

        case 0:

            enable\_y=1;

            enable\_x=0;

            for(int i=0;i<400;i++){

                clkwise\_x=1;

                clk=!clk;

                wait\_us(tempo);

            }

            break;

    }

}

void confirma(){ //Rotina de interrupção do botão de confirmação

    if (referenciar==0){

        referenciar=1;

        ciclo = 1;

    }

    if (fim\_referenciamento==1){

        referenciar=0;

        ciclo=2;

    }

    if (jog ==1){

        ciclo=3;

    }

    if(define\_volume==1){

        ciclo=4;

    }

    if(define\_volume==2){

        ciclo=5;

    }

    if(define\_volume==3){

        ciclo=6;

    }

    if(define\_volume==4){

        ciclo=7;

    }

    if(define\_volume==5){

        ciclo=8;

    }

    if(define\_volume==6){

        ciclo=9;

    }

}

int main(){

    //define em quais funções os botoes vão entrar

    botao\_confirma.fall(&confirma);

    botao\_chega.fall(&vermelho);

    botao\_emergencia.rise(&emergencia);

    sensor\_x\_1.fall(&fim\_de\_curso\_x\_1);

    sensor\_y\_1.fall(&fim\_de\_curso\_y\_1);

    sensor\_z\_1.fall(&fim\_de\_curso\_z\_1);

    //liga o lcd

    lcd.setBacklight(TextLCD::LightOn);

    //inicia o programas com os motores desligados

    enable\_x=1;

    enable\_y=1;

    enable\_z=1;

    volume = 0;

    pipeta =1;

    while(1){//loop principal

        switch(erro){

            case 1:

               while(erro==1){ //loop para aparecer no lcd a messagem emergencia, caso botão do acionado

                    lcd.cls();

                    lcd.locate(4,2);

                    lcd.printf("Emergencia");

                    wait(3);

                }

                break;

            }

        switch (ciclo) { //Ciclo do programa do ciclo total

            case 0:

                while(ciclo==0 && jog==0){ //loop para aparecer no lcd a messagem de intruções iniciais

                    lcd.cls();

                    wait\_us(10);

                    lcd.cls();

                    lcd.locate(8,1);

                    lcd.printf("Ola");

                    wait(3);

                    lcd.cls();

                    wait\_us(10);

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Aperte confirma");

                    lcd.locate(3,2);

                    lcd.printf("para iniciar o");

                    lcd.locate(3,3);

                    lcd.printf("referenciamento");

                    wait(4);

                }

                break;

            case 1: // rotina de referenciamento em todos os eixos

                lcd.cls();

                wait\_us(10);

                lcd.cls();

                lcd.locate(2,1);

                lcd.printf("Referenciando...");

                switch (referenciar) {

                    case 1:

                        enable\_z=0;

                        clkwise\_z=1;

                        while(referenciar==1){

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        break;

                    case 2:

                        enable\_y=0;

                        clkwise\_y=1;

                        while(referenciar==2){

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        break;

                    case 3:

                        enable\_x=0;

                        clkwise\_x=0;

                        while(referenciar==3){

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        break;

                    case 4:

                        while(referenciar==4){

                            lcd.cls();

                            wait\_us(10);

                            lcd.cls();

                            lcd.locate(2,1);

                            lcd.printf("Referenciamento");

                            lcd.locate(5,2);

                            lcd.printf("concluido");

                            wait(3);

                            lcd.cls();

                            wait\_us(10);

                            lcd.cls();

                            lcd.locate(3,1);

                            lcd.printf("Aperte confirma");

                            lcd.locate(2,2);

                            lcd.printf("para definir a");

                            lcd.locate(8,3);

                            lcd.printf("fonte");

                            wait(3);

                        }

                        break;

                    }

                    break;

            case 2: //Rotina de jog para fonte/reservatorio de liquido

                while(ciclo==2){

                    jog=1;

                    enable\_x=1;

                    enable\_y=1;

                    enable\_z=1;

                    lcd.cls();

                    lcd.locate(2,1);

                    lcd.printf("Fonte X %i",fonte\_x);

                    lcd.locate(2,2);

                    lcd.printf("Fonte Y %i",fonte\_y);

                    lcd.locate(2,3);

                    lcd.printf("Fonte Z %i",fonte\_z);

                    wait(0.4);

                    while(x\_mais==0){

                        if(fonte\_x<curso\_x){

                            enable\_x=0;

                            fonte\_x++;

                            clkwise\_x=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(x\_menos==0){

                        if(fonte\_x>0){

                            enable\_x=0;

                            fonte\_x--;

                            clkwise\_x=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(y\_mais==0){

                        if(fonte\_y<curso\_y){

                            enable\_y=0;

                            fonte\_y++;

                            clkwise\_y=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(y\_menos==0){

                        if(fonte\_y>0){

                            enable\_y=0;

                            fonte\_y--;

                            clkwise\_y=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

//

                    while(z\_menos==0){

                        if(fonte\_z<curso\_z){

                            enable\_z=0;

                            fonte\_z++;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                    while(z\_mais==0){

                        if(fonte\_z>0){

                            enable\_z=0;

                            fonte\_z--;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                }

                break;

            case 3:

                if(voltar\_origem == 0){ //rotina para que depois de definido qual posição da fonte/reservatorio, maquina volta para origem

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Voltando para");

                    lcd.locate(5,2);

                    lcd.printf("a origem");

                    for(int z=0; z<(fonte\_z);z++){

                        enable\_x=1;

                        enable\_y=1;

                        enable\_z=0;

                        clkwise\_z=1;

                        clk=!clk;

                        wait\_us(tempo);

                    }

                    for(int x=0; x<(fonte\_x);x++){

                        enable\_x=0;

                        enable\_y=1;

                        enable\_z=1;

                        clkwise\_x=0;

                        clk=!clk;

                        wait\_us(tempo);

                    }

                    for(int y=0; y<(fonte\_y);y++){

                        enable\_x=1;

                        enable\_y=0;

                        enable\_z=1;

                        enable\_y=0;

                        clkwise\_y=1;

                        clk=!clk;

                        wait\_us(tempo);

                    }

                    voltar\_origem=1;

                }

                if (voltar\_origem==1){ //rotina para definir volume no pote 1

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Defina o volume");

                    lcd.locate(3,2);

                    lcd.printf("no pote %i",index);

                    lcd.locate(3,3);

                    lcd.printf("%i  ml",v1);

                    index++;

                    define\_volume++;

                    while(ciclo==3){ //loop para definir volume no pote 1

                        lcd.cls();

                        lcd.locate(3,1);

                        lcd.printf("Defina o volume");

                        lcd.locate(3,2);

                        lcd.printf("no pote %i",index);

                        lcd.locate(3,3);

                        lcd.printf("%i  ml",v1);

                        wait(0.8);

                        while(z\_mais==0){

                            v1++;

                            wait(0.2);

                        }

                        while(z\_menos==0){

                            if(v1>=0){

                                v1--;

                                wait(0.2);

                            }

                        }

                    }

                }

                break;

////

            case 4: //rotina para definir posição do pote 1

                lcd.cls();

                wait\_us(10);

                lcd.cls();

                lcd.locate(3,1);

                lcd.printf("Deposito X %i",x1);

                lcd.locate(3,2);

                lcd.printf("Deposito Y %i",y1);

                lcd.locate(3,3);

                lcd.printf("Deposito Z %i",z1);

                define\_volume++;

                while(ciclo==4){

                    enable\_x=1;

                    enable\_y=1;

                    enable\_z=1;

                    lcd.cls();

                    wait\_us(10);

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Deposito X %i",x1);

                    lcd.locate(3,2);

                    lcd.printf("Deposito Y %i",y1);

                    lcd.locate(3,3);

                    lcd.printf("Deposito Z %i",z1);

                    wait(0.8);

                    while(x\_mais==0){

                        if(x1<curso\_x){

                            enable\_x=0;

                            clkwise\_x=1;

                            x1 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(x\_menos==0){

                        if(x1>0){

                            enable\_x=0;

                            clkwise\_x=0;

                            x1--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(y\_mais==0){

                        if(y1<curso\_y){

                            enable\_y=0;

                            clkwise\_y=0;

                            y1 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(y\_menos==0){

                        if(y1>0){

                            enable\_y=0;

                            clkwise\_y=1;

                            y1--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(z\_menos==0){

                        if(z1<curso\_z){

                            enable\_z=0;

                            clkwise\_z=0;

                            z1 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                    while(z\_mais==0){

                        if(z1>0){

                            enable\_z=0;

                            clkwise\_z=1;

                            z1--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                }

                break;

            case 5: //rotina para definir volume no pote 2

                lcd.cls();

                lcd.locate(3,1);

                lcd.printf("Defina o volume");

                lcd.locate(3,2);

                lcd.printf("no pote %i",index);

                lcd.locate(3,3);

                lcd.printf("%i  ml",v2);

                index++;

                define\_volume++;

                while(ciclo==5){

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Defina o volume");

                    lcd.locate(3,2);

                    lcd.printf("no pote %i",index);

                    lcd.locate(3,3);

                    lcd.printf("%i  ml",v2);

                    wait(0.8);

                    while(z\_mais==0){

                        v2++;

                        wait(0.2);

                    }

                    while(z\_menos==0){

                        if(v2>=0){

                            v2--;

                            wait(0.2);

                        }

                    }

                }

                break;

////

            case 6: //rotina para definir posição do pote 2

                x2=x1;

                y2=y1;

                z2=z1;

                lcd.cls();

                wait\_us(10);

                lcd.cls();

                lcd.locate(3,1);

                lcd.printf("Deposito X %i",x2);

                lcd.locate(3,2);

                lcd.printf("Deposito Y %i",y2);

                lcd.locate(3,3);

                lcd.printf("Deposito Z %i",z2);

                define\_volume++;

                while(ciclo==6){

                    enable\_x=1;

                    enable\_y=1;

                    enable\_z=1;

                    lcd.cls();

                    wait\_us(10);

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Deposito X %i",x2);

                    lcd.locate(3,2);

                    lcd.printf("Deposito Y %i",y2);

                    lcd.locate(3,3);

                    lcd.printf("Deposito Z %i",z2);

                    wait(0.8);

                    while(x\_mais==0){

                        if(x2<curso\_x){

                            enable\_x=0;

                            clkwise\_x=1;

                            x2++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(x\_menos==0){

                        if(x2>0){

                            enable\_x=0;

                            clkwise\_x=0;

                            x2--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(y\_mais==0){

                        if(y2<curso\_y){

                            enable\_y=0;

                            clkwise\_y=0;

                            y2 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(y\_menos==0){

                        if(y2>0){

                            enable\_y=0;

                            clkwise\_y=1;

                            y2--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(z\_menos==0){

                        if(z2<curso\_z){

                            enable\_z=0;

                            clkwise\_z=0;

                            z2 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                    while(z\_mais==0){

                        if(z2>0){

                            enable\_z=0;

                            clkwise\_z=1;

                            z2--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                }

                break;

//

            case 7: //rotina para definir volume no pote 3

                define\_volume++;

                lcd.cls();

                lcd.locate(3,1);

                lcd.printf("Defina o volume");

                lcd.locate(3,2);

                lcd.printf("no pote %i",index);

                lcd.locate(3,3);

                lcd.printf("%i  ml",v3);

                index++;

                while(ciclo==7){

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Defina o volume");

                    lcd.locate(3,2);

                    lcd.printf("no pote %i",index);

                    lcd.locate(3,3);

                    lcd.printf("%i  ml",v3);

                    wait(0.8);

                    while(z\_mais==0){

                        v3++;

                        wait(0.2);

                    }

                    while(z\_menos==0){

                        if(v3>=0){

                            v3--;

                            wait(0.2);

                        }

                    }

                }

                break;

////

            case 8: //rotina para definir posição do pote 3

                x3=x2;

                y3=y2;

                z3=z2;

                lcd.cls();

                wait\_us(10);

                lcd.cls();

                lcd.locate(3,1);

                lcd.printf("Deposito X %i",x3);

                lcd.locate(3,2);

                lcd.printf("Deposito Y %i",y3);

                lcd.locate(3,3);

                lcd.printf("Deposito Z %i",z3);

                define\_volume++;

                while(ciclo==8){

                    enable\_x=1;

                    enable\_y=1;

                    enable\_z=1;

                    lcd.cls();

                    wait\_us(10);

                    lcd.cls();

                    lcd.locate(3,1);

                    lcd.printf("Deposito X %i",x3);

                    lcd.locate(3,2);

                    lcd.printf("Deposito Y %i",y3);

                    lcd.locate(3,3);

                    lcd.printf("Deposito Z %i",z3);

                    wait(0.8);

                    while(x\_mais==0){

                        if(x3<curso\_x){

                            enable\_x=0;

                            clkwise\_x=1;

                            x3 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(x\_menos==0){

                        if(x3>0){

                            enable\_x=0;

                            clkwise\_x=0;

                            x3--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_x=1;

                        }

                    }

                    while(y\_mais==0){

                        if(y3<curso\_y){

                            enable\_y=0;

                            clkwise\_y=0;

                            y3 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(y\_menos==0){

                        if(y3>0){

                            enable\_y=0;

                            clkwise\_y=1;

                            y3--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_y=1;

                        }

                    }

                    while(z\_menos==0){

                        if(z3<curso\_z){

                            enable\_z=0;

                            clkwise\_z=0;

                            z3 ++;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                    while(z\_mais==0){

                        if(z3>0){

                            enable\_z=0;

                            clkwise\_z=1;

                            z3--;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        else{

                            enable\_z=1;

                        }

                    }

                }

                break;

            case 9: //rotina do ciclo automatico

                enable\_x=1;

                enable\_y=1;

                enable\_z=1;

                lcd.cls();

                wait\_us(10);

                lcd.cls();

                lcd.locate(3,2);

                lcd.printf("Ciclo");

                lcd.locate(3,3);

                lcd.printf("Automatico");

                wait(0.5);

                if(v3>0){ //começa sempre da ultima posição definida

                    for(int j=0;j<v3;j++){ //loop roda ate que o volume desejado no pote seja atingido

                        for(int n=0;n<=z3;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_x-x3);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x3)<0){

                                clkwise\_x=0;

                            }

                            else{

                                clkwise\_x=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y3);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y3)<0){

                                clkwise\_y=1;

                            }

                            else{

                                clkwise\_y=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=fonte\_z;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        pipeta=!pipeta;//acionamento da pipeta

                        wait(2);

                        for(int n=0;n<=fonte\_z;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_x-x3);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x3)<0){

                                clkwise\_x=1;

                            }

                            else{

                                clkwise\_x=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y3);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y3)<0){

                                clkwise\_y=0;

                            }

                            else{

                                clkwise\_y=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=z3;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        pipeta=!pipeta;//acionamento da pipeta

                        wait(2);

                    }

                }

                if(v2>0){//inicia o ciclo para o pote 2

                    if(v3>0){//caso tenha sido definido um pote 3 ele vai para a fonte em relação ao pote

                        for(int n=0;n<=abs(x3-x2);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((x3-x2)<0){

                                clkwise\_x=0;

                            }

                            else{

                                clkwise\_x=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(y3-y2);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((y3-y2)<0){

                                clkwise\_y=1;

                            }

                            else{

                                clkwise\_y=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                    }

                    for(int j=0;j<v2;j++){ //loop roda ate que o volume desejado no pote seja atingido

                        for(int n=0;n<=z2;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_x-x2);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x2)<0){

                                clkwise\_x=0;

                            }

                            else{

                                clkwise\_x=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y2);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y2)<0){

                                clkwise\_y=1;

                            }

                            else{

                                clkwise\_y=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=fonte\_z;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        pipeta=!pipeta; //aciona a pipeta

                        wait(5);

                        for(int n=0;n<=fonte\_z;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_x-x2);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x2)<0){

                                clkwise\_x=1;

                            }

                            else{

                                clkwise\_x=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y2);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y2)<0){

                                clkwise\_y=0;

                            }

                            else{

                                clkwise\_y=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=z2;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        pipeta=!pipeta; //aciona a pipeta

                        wait(4);

                    }

                }

                if(v1>0){//inicia o ciclo para o pote 2

                    if(v2>0){//caso tenha sido definido um pote 2 ele vai para a fonte em relação ao pote

                       for(int n=0;n<=z2;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                            //pipeta=!pipeta;

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_x-x2);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x2)<0){

                                clkwise\_x=0;

                            }

                            else{

                                clkwise\_x=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y2);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y2)<0){

                                clkwise\_y=1;

                            }

                            else{

                                clkwise\_y=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                    }

                    for(int j=0;j<v1;j++){ //loop roda ate que o volume desejado no pote seja atingido

                        for(int n=0;n<=fonte\_z;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        pipeta=!pipeta; //aciona a pipeta

                        wait(4);

                        for(int n=0;n<=fonte\_z;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        for(int n=0;n<=abs(fonte\_x-x1);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x1)<0){

                                clkwise\_x=1;

                            }

                            else{

                                clkwise\_x=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y1);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y1)<0){

                                clkwise\_y=0;

                            }

                            else{

                                clkwise\_y=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=z1;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=0;

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        pipeta=!pipeta; //aciona a pipeta

                        wait(4);

                       for(int n=0;n<=z1;n++){

                            enable\_x=1;

                            enable\_y=1;

                            enable\_z=0;

                            clkwise\_z=1;

                            clk=!clk;

                            wait\_us(tempo);

                            //pipeta=!pipeta;

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_x-x1);n++){

                            enable\_x=0;

                            enable\_y=1;

                            enable\_z=1;

                            if ((fonte\_x-x1)<0){

                                clkwise\_x=1;

                            }

                            else{

                                clkwise\_x=0;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                        for(int n=0;n<=abs(fonte\_y-y1);n++){

                            enable\_x=1;

                            enable\_y=0;

                            enable\_z=1;

                            if ((fonte\_y-y1)<0){

                                clkwise\_y=0;

                            }

                            else{

                                clkwise\_y=1;

                            }

                            clk=!clk;

                            wait\_us(tempo);

                        }

                        wait(0.2);

                    }

                }

                //messagem de ciclo concluido

                lcd.cls();

                wait\_us(10);

                lcd.cls();

                lcd.locate(3,1);

                lcd.printf("Ciclo");

                lcd.locate(3,2);

                lcd.printf("Concluido");

                wait(0.5);

                break;

        }

    }

}