# Bài 1. Led nhấp nháy

## Mô tả:

Bài này thực hiện việc tự động bật/tắt đèn trong vòng 1 giây. Led được nối vào cổng 13 của Arduino uno board.

## Sơ đồ thiết kế:

Schematic

Description automatically generated with low confidence

Hình 1: Sơ đồ kết nối của hệ thống

## Link kiện:

* + 1 đèn led đỏ
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| void **setup**() {  pinMode(13, OUTPUT);  }  void **loop**() {  digitalWrite(13, HIGH);  delay(1000);  digitalWrite(13, LOW);  delay(1000);  } |

# Bài 2. Nút bấm bật đèn Led

## Mô tả:

Bài này thực hiện việc nhấn nút bấm để bật đèn và thả nút bấm tắt đèn. Led được nối vào cổng 13 của Arduino uno board. Nút bấm được nối vào cổng số 2 của Arduino uno board.

## Sơ đồ thiết kế:

A picture containing chart

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Hình 2: Sơ đồ mạch

## Link kiện:

* + 1 Led vàng
  + 2 Điện trở R1,R2: 100 (Ohm)
  + 1 Nút bấm
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| int x=0;  void **setup**() {  pinMode(13, OUTPUT);  pinMode(2, INPUT);  }  void **loop**() {  x=digitalRead(2);  if(x==HIGH)  {  digitalWrite(13,HIGH);  }else{  digitalWrite(13,LOW);  }  delay(1000);  } |

# Bài 3: Cảm biến nhiệt độ

## Mô tả:

Khi cảm biến nhiệt độ quá 37 độ thì đèn sẽ tự sáng trong vòng 100ms. Led được nối vào cổng 10 của Arduino uno board. Cảm biến nhiệt độ được nối vào cổng A0 của Arduino uno board.

## Sơ đồ thiết kế:

Diagram

Description automatically generated

Hình 3:Sơ đồ mạch

## Link kiện:

* + 1 Led xanh
  + 1 Điện trở R1: 100 (Ohm)
  + 1 Cảm biến nhiệt độ TMP36
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| void setup() {  pinMode(10,OUTPUT);  Serial.begin(96000);  }  void loop() {  int x= analogRead(A0);  int t=map(x,0,410,-50,150);  if(t>=36)  {  digitalWrite(10,HIGH);  }else{  digitalWrite(10,LOW);  }  delay(100);  } |

# Bài 4: Led sáng dần

## Mô tả:

Bài này thực hiện xuất các mức điện áp đầu ra thay đổi từ 0-5V để làm cho led sáng dần. Led được nối vào cổng 9 của Arduino uno board.

## Sơ đồ thiết kế:

Graphical user interface

Description automatically generated

Hình 4:Sơ đồ mạch

## Link kiện:

* + 1 Led xanh
  + 1 Điện trở R1: 100 (Ohm)
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| int brightness=0;  void **setup**() {  pinMode(9,OUTPUT);  }  void **loop**() {  for (brightness =0; brightness <= 255; brightness+=5)  {  analogWrite(9,brightness);  delay(100);  }  for(brightness=255; brightness>=0;brightness-=5)  {  analogWrite(9, brightness);  delay(100);  }  } |

# Bài 5: Điều khiển độ sáng của Led qua chiết áp

## Mô tả:

Bài này thực hiện xoay chiết áp để điều chỉnh độ sáng của đèn led thông qua biến trở ở cổng số 9 của mạch Arduino uno .

## Sơ đồ thiết kế:

A picture containing chart

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Hình 5:Sơ đồ mạch

## Link kiện:

* + 1 Led BIBY
  + 1 Điện trở R1: 100 (Ohm)
  + 1 chiết áp
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| int x=0;  void **setup**()  {  pinMode(A0, INPUT);  pinMode(9, OUTPUT);  }  void **loop**()  {  x=analogRead(A0);  int brightness = map(x,0,1023,0,255);  analogWrite(9,brightness);  } |

# Bài 6: Led RGB

## Mô tả:

Bài này thực hiện led RGB được nối với 3 cổng 11,12,13 tương ứng với đèn màu blue, green, red của mạch Arduino uno, sau đó ta code tắt 1 đèn sẽ ra được màu trộn tương ứng .

## Sơ đồ thiết kế:

Chart, schematic

Description automatically generated with medium confidence

Hình 6:Sơ đồ mạch

## Link kiện:

* + 1 Led RGB
  + 1 mạch Arduino uno

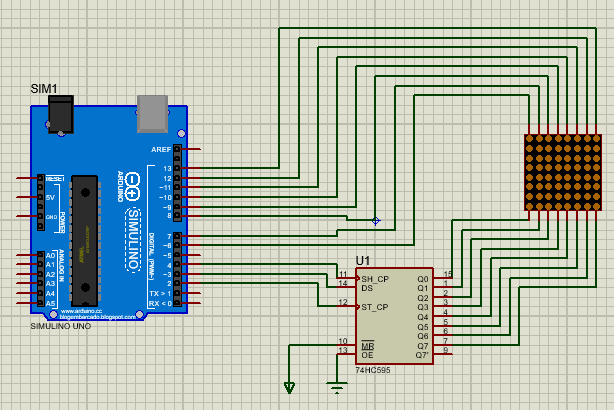
## Mã lệnh chính:

|  |
| --- |
| int LEDblue=12;  int LEDred=13;  int LEDgreen=11;  void **setup**()  {  pinMode(LEDblue, OUTPUT);  pinMode(LEDgreen, OUTPUT);  pinMode(LEDred, OUTPUT);  }  void **loop**()  {  digitalWrite(LEDred,HIGH);  digitalWrite(LEDgreen,LOW);  digitalWrite(LEDblue,LOW);  delay(1000);    digitalWrite(LEDred,LOW);  digitalWrite(LEDgreen,HIGH);  digitalWrite(LEDblue,LOW);  delay(1000);    digitalWrite(LEDred,LOW);  digitalWrite(LEDgreen,LOW);  digitalWrite(LEDblue,HIGH);  delay(1000);    digitalWrite(LEDred,HIGH);  digitalWrite(LEDgreen,HIGH);  digitalWrite(LEDblue,LOW);  delay(1000);    digitalWrite(LEDred,HIGH);  digitalWrite(LEDgreen,LOW);  digitalWrite(LEDblue,HIGH);  delay(1000);  } |

# Bài 7: Led ma trận 8x8

## Mô tả:

## Sơ đồ thiết kế:



Hình 7:Sơ đồ mạch

## Link kiện:

* + 1 Matrix 8x8 Orange
  + 1 IC 74HC595
  + 1 mạch Arduino uno

## Mã lệnh chính:

* Quét ma trận

|  |
| --- |
| #define SH\_CP 4  #define DS 3  #define ST\_CP 2  byte chu[][8]={  (0xFF,0x03,0x01,0xED,0xED,0x01,0x03,0xFF),//A  (0xFF,0x01,0x01,0x6D,0x6D,0x01,0x93,0xFF),//B  };  void setup(){  for(int i=2;i<=13;i++){  pinMode(i,OUTPUT);  }  }  void loop(){  quetled();  }  void quetled(){  for(int i=0;i<=8;i++){  digitalWrite(ST\_CP,0);  digitalWrite(6,1);  digitalWrite(7,2);  digitalWrite(8,3);  digitalWrite(9,4);  digitalWrite(10,5);  digitalWrite(11,6);  digitalWrite(12,7);  digitalWrite(13,8);  shiftOut(DS,SH\_CP,LSBFIRST,(0B10000000 >> i)^0B11111111);  digitalWrite(ST\_CP,1);  delay(100);  }  } |

|  |
| --- |
| #define SH\_CP 4  #define DS 3  #define ST\_CP 2  byte chu[][8] = {  {0xFF,0x03,0x01,0xED,0xED,0x01,0x03,0xFF}, //A  {0xFF,0x01,0x01,0x6D,0x6D,0x01,0x93,0xFF},//B  {0xFF,0x83,0x01,0x7D,0x7D,0x39,0xBB,0xFF},//C  {0xFF,0x01,0x01,0x7D,0x7D,0x01,0x83,0xFF},//D  {0xFF,0x01,0x01,0x6D,0x6D,0x6D,0x7D,0xFF},//E  {0xFF,0x01,0x01,0xED,0xED,0xED,0xFD,0xFF},//F  {0xFF,0x83,0x01,0x7D,0x5D,0x19,0x9B,0xFF},//G  {0xFF,0x01,0x01,0xEF,0xEF,0x01,0x01,0xFF},//H  {0xFF,0xFF,0x7D,0x01,0x01,0x7D,0xFF,0xFF},//I  {0xFF,0x9F,0x9F,0x7D,0x01,0x81,0xFD,0xFF},//J  {0xFF,0x01,0x01,0xC7,0x93,0x39,0x7D,0xFF},//K  {0xFF,0x01,0x01,0x7F,0x7F,0x7F,0x7F,0xFF},//L  {0xFF,0x01,0x01,0xF3,0xE7,0xF3,0x01,0x01},//M  {0xFF,0x01,0x01,0xF3,0xE7,0xCF,0x01,0x01},//N  {0xFF,0x83,0x01,0x7D,0x7D,0x01,0x83,0xFF},//O  {0xFF,0x01,0x01,0xDD,0xDD,0xC1,0xE3,0xFF},//P  {0xFF,0xC3,0x81,0xBD,0x9D,0x01,0x43,0xFF},//Q  {0xFF,0x01,0x01,0xCD,0x8D,0x21,0x73,0xFF},//R  {0xFF,0xB3,0x21,0x6D,0x6D,0x09,0x9B,0xFF},//S  {0xFF,0xF9,0xFD,0x01,0x01,0xFD,0xF9,0xFF},//T  {0xFF,0x81,0x01,0x7F,0x7F,0x01,0x01,0xFF},//U  {0xFF,0xC1,0x81,0x3F,0x3F,0x81,0xC1,0xFF},//V  {0xFF,0x01,0x01,0x9F,0xCF,0x9F,0x01,0x01},//W  {0xFF,0x39,0x11,0xC7,0xEF,0xC7,0x11,0x39},//X  {0xFF,0xF1,0xE1,0x0F,0x0F,0xE1,0xF1,0xFF},//Y  {0xFF,0x3D,0x1D,0x4D,0x65,0x71,0x79,0xFF},//Z  {0xFF,0xFF,0xFF,0xFF,0xFF,0xFF,0xFF,0xFF},  };  char character[]={'A','B','C','D','E','F','G','H','I','J','K','L','M','N','O','P','Q','R','S','T','U','V','W','X','Y','Z',' '};  void setup() {  for(int i = 2; i <= 13; i++){  pinMode(i,OUTPUT);  }  }  void loop() {  for(int i = 0; i<37;i++){  for(int j = 0; j<50;j++){  hienchu(chu,i);  }  }  }  void hienchu(byte chaychu[][8], int input){  for(int i = 0;i<8;i++){  digitalWrite(ST\_CP,0);  digitalWrite(i+6,1);  shiftOut(DS,SH\_CP,MSBFIRST,chaychu[input][i]);  digitalWrite(ST\_CP,1);  delay(1);  digitalWrite(i+6,0);  }  } |

# Bài 8: Sáng 8 Led theo một trình tự

## Mô tả:

Bài này thực hiện 8 led sáng lên thông qua IC 74HC595, các chân SH\_CP, DS, ST\_CP của IC 74HC595 được nối với cổng số 7,5,6 của mạch Arduino uno, chân MR nối với power và OE nối với ground, các chân Q0-7 được nối với số chân đèn tương ứng.

## Sơ đồ thiết kế:

Diagram, schematic

Description automatically generated

Hình 8:Sơ đồ mạch

## Link kiện:

* + 8 Led: BIBY,BIGY,BIRG,BIRY,BLUE,GREEN,RED,YELLOW
  + 1 IC 74HC595
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| #define \_latch 6  #define \_clock 7  #define \_data 5  void setup()  {  pinMode(\_latch, OUTPUT);  pinMode(\_clock, OUTPUT);  pinMode(\_data, OUTPUT);  }  void loop()  {  //chot IC  digitalWrite(\_latch, LOW);  //day du lieu ra IC  int soLieu=255;//B11111111, hoac 0xff  shiftOut(\_data,\_clock,LSBFIRST,soLieu);  //mo chot, de IC out du lieu ra  digitalWrite(\_latch, HIGH);  } |

# Bài 9: Điều khiển động cơ

## Mô tả:

## Sơ đồ thiết kế:

Diagram, schematic

Description automatically generated

Hình 9:Sơ đồ mạch

## Link kiện:

* + 2 motor
  + 1 IC L293D
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| int enA=9;  int in1=8;  int in2=7;  int enB=3;  int in3=5;  int in4=4;  void setup()  {  pinMode(enA, OUTPUT);  pinMode(enB, OUTPUT);  pinMode(in1, OUTPUT);  pinMode(in2, OUTPUT);  pinMode(in3, OUTPUT);  pinMode(in4, OUTPUT);    digitalWrite(in1, LOW);  digitalWrite(in2, LOW);  digitalWrite(in3, LOW);  digitalWrite(in4, LOW);  }  void loop()  {  directionControl();  delay(1000);  speedControl();  delay(1000);  }  void directionControl()  {  analogWrite(enA,255);  analogWrite(enB,255);    digitalWrite(in1,HIGH);  digitalWrite(in2,LOW);  digitalWrite(in3,HIGH);  digitalWrite(in4,LOW);  delay(2000);    digitalWrite(in1,LOW);  digitalWrite(in2,HIGH);  digitalWrite(in3, LOW);  digitalWrite(in4,HIGH);  delay(2000);    digitalWrite(in1,LOW);  digitalWrite(in2,LOW);  digitalWrite(in3,LOW);  digitalWrite(in4,LOW);  }  void speedControl()  {  digitalWrite(in1,LOW);  digitalWrite(in2,HIGH);  digitalWrite(in3, LOW);  digitalWrite(in4,HIGH);    for(int i=0;i<256;i++)  {  analogWrite(enA,i);  analogWrite(enB,i);  delay(20);  }    for(int i=255;i>=0;--i)  {  analogWrite(enA,i);  analogWrite(enB,i);  delay(20);  }    digitalWrite(in1,LOW);  digitalWrite(in2,LOW);  digitalWrite(in3,LOW);  digitalWrite(in4,LOW);  } |

# Bài 10: Led 7 đoạn

## Mô tả:

Bài này thực hiện chạy led 7 đoạn hiển thị số từ 0 🡪 9 thông qua IC4511 và điện trở lớn, cổng A,B,C,D nối với cổng 3,2,1,0 của mạch Arduino, cổng LT,BI nối với power, cổng LE nối vs đất, bảng mạch led 7 đoạn được nối với đất.

## Sơ đồ thiết kế:

Diagram, schematic

Description automatically generated

Hình 10:Sơ đồ mạch

## Link kiện:

* + 1 4511
  + 1 điện trở: 100(Ohm)
  + 1 led 7 đoạn blue
  + 1 mạch Arduino uno

## Mã lệnh chính:

|  |
| --- |
| int A=0, B=1, C=2, D=3;  void setup() {  pinMode(A,OUTPUT);  pinMode(B,OUTPUT);  pinMode(C,OUTPUT);  pinMode(D,OUTPUT);  }  void KHONG(){  digitalWrite(A,LOW);  digitalWrite(B,LOW);  digitalWrite(C,LOW);  digitalWrite(D,LOW);  }  void MOT(){  digitalWrite(A,LOW);  digitalWrite(B,LOW);  digitalWrite(C,LOW);  digitalWrite(D,HIGH);  }  void HAI(){  digitalWrite(A,LOW);  digitalWrite(B,LOW);  digitalWrite(C,HIGH);  digitalWrite(D,LOW);  }  void BA(){  digitalWrite(A,LOW);  digitalWrite(B,LOW);  digitalWrite(C,HIGH);  digitalWrite(D,HIGH);  }  void BON(){  digitalWrite(A,LOW);  digitalWrite(B,HIGH);  digitalWrite(C,LOW);  digitalWrite(D,LOW);  }  void NAM(){  digitalWrite(A,LOW);  digitalWrite(B,HIGH);  digitalWrite(C,LOW);  digitalWrite(D,HIGH);  }  void SAU(){  digitalWrite(A,LOW);  digitalWrite(B,HIGH);  digitalWrite(C,HIGH);  digitalWrite(D,LOW);  }  void BAY(){  digitalWrite(A,LOW);  digitalWrite(B,HIGH);  digitalWrite(C,HIGH);  digitalWrite(D,HIGH);  }  void TAM(){  digitalWrite(A,HIGH);  digitalWrite(B,LOW);  digitalWrite(C,LOW);  digitalWrite(D,LOW);  }  void CHIN(){  digitalWrite(A,HIGH);  digitalWrite(B,LOW);  digitalWrite(C,LOW);  digitalWrite(D,HIGH);  }  void loop() {  KHONG();  delay(1000);  MOT();  delay(1000);  HAI();  delay(1000);  BA();  delay(1000);  BON();  delay(1000);  NAM();  delay(1000);  SAU();  delay(1000);  BAY();  delay(1000);  TAM();  delay(1000);  CHIN();  delay(1000);  } |

# Bài 11: STM32

## Mô tả:

Bài này thực hiện chạy sáng 4 đèn led đơn giản thông qua 4 điện trở được nối với cổng 58,59,60,61 của mạch STM32F401VE.

## Sơ đồ thiết kế:

Chart

Description automatically generated

Hình 11:Sơ đồ mạch

## Link kiện:

* + 4 led blue
  + 4 điện trở: 100(Ohm)
  + 1 mạch STM32F401VE

## Mã lệnh chính:

|  |
| --- |
| #include "main.h"  void SystemClock\_Config(void);  static void MX\_GPIO\_Init(void);  int main(void)  {  HAL\_Init();  SystemClock\_Config();  MX\_GPIO\_Init();  while (1)  {  /\*HAL\_GPIO\_TogglePin(GPIOD,GPIO\_PIN\_11);  HAL\_Delay(500);  HAL\_GPIO\_TogglePin(GPIOD,GPIO\_PIN\_12);  HAL\_Delay(500);  HAL\_GPIO\_TogglePin(GPIOD,GPIO\_PIN\_13);  HAL\_Delay(500);  HAL\_GPIO\_TogglePin(GPIOD,GPIO\_PIN\_14);  HAL\_Delay(500);\*/    }  } |

# Bài 12: Led trái tim

## Mô tả:

## Sơ đồ thiết kế:

Chart, scatter chart

Description automatically generated

Hình 12:Sơ đồ mạch

## Link kiện:

* + 32 led red
  + 4 điện trở RN1: 150(Ohm)
  + 1 mạch STM32F401VE

## Mã lệnh chính:

|  |
| --- |
| #include "main.h"  void SystemClock\_Config(void);  static void MX\_GPIO\_Init(void);  void SangHetLed();  void TatHetLed();  void SangLanLuot();  void SangTatLanLuot();  int main(void)  {  HAL\_Init();  SystemClock\_Config();  MX\_GPIO\_Init();    while (1)  {  SangHetLed();  HAL\_Delay(1000);  TatHetLed();  HAL\_Delay(1000);  SangLanLuot();  HAL\_Delay(1000);  SangTatLanLuot();  HAL\_Delay(1000);  }  }  void SangHetLed(){  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_2, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_3, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_5, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_6, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_7, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_8, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_9, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_10, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_11, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_12, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_13, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_14, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_15, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_2, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_3, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_5, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_6, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_7, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_8, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_9, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_10, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_11, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_12, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_13, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_14, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_15, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_1, GPIO\_PIN\_SET);  }  void TatHetLed(){  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_0, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_1, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_2, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_3, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_4, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_5, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_6, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_7, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_8, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_9, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_10, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_11, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_12, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_13, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_14, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_15, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_0, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_1, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_2, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_3, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_4, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_5, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_6, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_7, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_8, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_9, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_10, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_11, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_12, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_13, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_14, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_15, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_0, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_1, GPIO\_PIN\_RESET);  }  void SangLanLuot(){  TatHetLed();  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_2, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_3, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_5, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_6, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_7, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_8, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_9, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_10, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_11, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_12, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_13, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_14, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_15, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_2, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_3, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_5, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_6, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_7, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_8, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_9, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_10, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_11, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_12, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_13, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_14, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_15, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_Delay(100);  }  void SangTatLanLuot(){  TatHetLed();  //----------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_0, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_1, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_2, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_2, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //---------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_3, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_3, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_4, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_5, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_5, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_6, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_6, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_7, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_7, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_8, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_8, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_9, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_9, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_10, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_10, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_11, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_11, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_12, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_12, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_13, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_13, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_14, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_14, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_15, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOD, GPIO\_PIN\_15, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_0, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_1, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_2, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_2, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_3, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_3, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_4, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_5, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_5, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_6, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_6, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_7, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_7, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_8, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_8, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_9, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_9, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_10, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_10, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_11, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_11, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_12, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_12, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_13, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_13, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_14, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_14, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_15, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOE, GPIO\_PIN\_15, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_0, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_0, GPIO\_PIN\_RESET);  HAL\_Delay(100);  //--------------------------------------------------------  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_1, GPIO\_PIN\_SET);  HAL\_Delay(100);  HAL\_GPIO\_WritePin (GPIOC, GPIO\_PIN\_1, GPIO\_PIN\_RESET);  HAL\_Delay(100);  } |

# Bài 13: STM32 Ngắt ngoài

## Mô tả:

## Sơ đồ thiết kế:

Chart

Description automatically generated

Hình 13:Sơ đồ mạch

## Link kiện:

* + 4 led green
  + 5 điện trở: 100(Ohm)
  + 1 nút bấm
  + 1 mạch STM32F401VE

## Mã lệnh chính:

|  |
| --- |
| #include "main.h"  void SystemClock\_Config(void);  static void MX\_GPIO\_Init(void);  int main(void)  {  HAL\_Init();  SystemClock\_Config();  MX\_GPIO\_Init();  while (1)  {  HAL\_GPIO\_TogglePin(GPIOD,GPIO\_PIN\_0|GPIO\_PIN\_1|GPIO\_PIN\_2);  HAL\_Delay(1000);  }    }//het ham main  //chuong trinh con phuc vu ngat  void HAL\_GPIO\_EXTI\_Callback(uint16\_t GPIO\_Pin){  if(GPIO\_Pin ==GPIO\_PIN\_0)  {  //HAL\_GPIO\_WritePin(GPIOA,GPIO\_PIN\_10,GPIO\_PIN\_SET);  HAL\_GPIO\_TogglePin(GPIOA,GPIO\_PIN\_10);  }  } |

# Bài 14: nút bấm STM32

## Mô tả:

## Sơ đồ thiết kế:

Chart, scatter chart

Description automatically generated

Hình 14:Sơ đồ mạch

## Link kiện:

* + 1 led blue
  + 1 nút bấm
  + 1 dotor DC
  + 2 điện trở: 100(Ohm)
  + 1 mạch STM32F401VE

## Mã lệnh chính:

|  |
| --- |
| #include "main.h"  void SystemClock\_Config(void);  static void MX\_GPIO\_Init(void);  int main(void)  {  HAL\_Init();  SystemClock\_Config();  MX\_GPIO\_Init();  while (1)//loop  {  //doc nut chan PD0  GPIO\_PinState pin0State = HAL\_GPIO\_ReadPin(GPIOD,GPIO\_PIN\_0);  if(pin0State == GPIO\_PIN\_SET)// nut duoc bam  {  //sang den , o chan 13  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_13,GPIO\_PIN\_SET);  }else  {  //tat  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_13,GPIO\_PIN\_RESET);  }  }  } |

# Bài 15: STM32 Nhiệt Độ

## Mô tả:

## Sơ đồ thiết kế:

Chart, scatter chart

Description automatically generated

Hình 15:Sơ đồ mạch

## Link kiện:

* + 1 LM35
  + 1 dotor DC
  + 1 mạch STM32F401VE

## Mã lệnh chính:

|  |
| --- |
| #include "main.h"  ADC\_HandleTypeDef hadc1;  void SystemClock\_Config(void);  static void MX\_GPIO\_Init(void);  static void MX\_ADC1\_Init(void);  float doC;  int main(void)  {    HAL\_Init();  HAL\_ADC\_Start\_IT(&hadc1);  SystemClock\_Config();  MX\_GPIO\_Init();  MX\_ADC1\_Init();  while (1)  {    }  }  //CT con phuc vu ngat, moi khi hoan thành xong mot ADC  void HAL\_ADC\_ConvCpltCallback(ADC\_HandleTypeDef\* hadc){  if(hadc->Instance == hadc1.Instance)  {  int giaTriDocDuoc\_Vol=HAL\_ADC\_GetValue(hadc);  //Chuyen sang do C  doC = 1.0\*giaTriDocDuoc\_Vol\*(5.0\*1000/1024)/10;  if(doC>25)  {  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_0,GPIO\_PIN\_SET);  }else  {  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_0,GPIO\_PIN\_RESET);  }  }  } |

# Bài 16: STM32 LCD

## Mô tả:

## Sơ đồ thiết kế:

Diagram, schematic

Description automatically generated

Hình 16:Sơ đồ mạch

## Link kiện:

* + 1 LCD
  + 1 POT
  + 1 mạch STM32F401VE

## Mã lệnh chính:

|  |
| --- |
| #include "main.h"  void SystemClock\_Config(void);  static void MX\_GPIO\_Init(void);  //Ham gui data/cmd ra 8 chan cua LCD  void send8BitLCD(char D){  //Dem D and so hoc voi 2^i de biet bit thu i=0 hay khac 0  //tim gia tri cac bit  int b0,b1,b2,b3,b4,b5,b6,b7;  if((D&1)==0) b0=0; //1==2^0  else b0=1;  if((D&2)==0) b1=0; //2==2^1  else b1=1;  if((D&4)==0) b2=0; //4==2^2  else b2=1;  if((D&8)==0) b3=0; //8==2^3  else b3=1;  if((D&16)==0) b4=0; //16==2^4  else b4=1;  if((D&32)==0) b5=0; //32==2^5  else b5=1;  if((D&64)==0) b6=0; //64==2^6  else b6=1;  if((D&128)==0) b7=0; //128==2^7  else b7=1;  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_0,b0);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_1,b1);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_2,b2);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_3,b3);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_4,b4);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_5,b5);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_6,b6);  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_7,b7);  }  //Ham gui lenh  void sendCMD2LCD(char cmd){  //B1. Done  //B2. Dat chan RS=0, de noi rang cmd la lenh  HAL\_GPIO\_WritePin(GPIOB,GPIO\_PIN\_3,GPIO\_PIN\_RESET);  //B3. Gui 8 bit CMD vao 8 pin  send8BitLCD(cmd);  //B4.Enable cho cmd -->lcd  HAL\_GPIO\_WritePin(GPIOB,GPIO\_PIN\_4, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin(GPIOB,GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_Delay(1);  }  void sendChar2LCD(char \_Char){  //B1. Done  //B2. Dat chan RS=1  HAL\_GPIO\_WritePin(GPIOB,GPIO\_PIN\_3,GPIO\_PIN\_RESET);  //B3. Gui 8 bit CMD vao 8 pin  send8BitLCD(\_Char);  //B4.Enable cho cmd -->lcd  HAL\_GPIO\_WritePin(GPIOB,GPIO\_PIN\_4, GPIO\_PIN\_RESET);  HAL\_GPIO\_WritePin(GPIOB,GPIO\_PIN\_4, GPIO\_PIN\_SET);  HAL\_Delay(1);  }  void sendString2LCD(char \*str){  for(int i=0;str[i] != '\0';i++){  sendChar2LCD(str[i]);  }  }  int main(void)  {  HAL\_Init();  SystemClock\_Config();  MX\_GPIO\_Init();  //xoa noi dung tren LCD  sendCMD2LCD(0x01);  //Bat hien thi man hinh, tat con tro  sendCMD2LCD(0x0C);  //Test thu chuoi Hello  sendString2LCD("Hello K60 NTU");  //Xuong dong 2  sendCMD2LCD(0x38); //CHE DO 2 DONG  sendCMD2LCD(0xC0); //TRO XUONG DONG 2    //sendString2LCD("HUYNH THI NGOC KHANH - NTU");  while (1)  {    }  } {    }  }  //CT con phuc vu ngat, moi khi hoan thành xong mot ADC  void HAL\_ADC\_ConvCpltCallback(ADC\_HandleTypeDef\* hadc){  if(hadc->Instance == hadc1.Instance)  {  int giaTriDocDuoc\_Vol=HAL\_ADC\_GetValue(hadc);  //Chuyen sang do C  doC = 1.0\*giaTriDocDuoc\_Vol\*(5.0\*1000/1024)/10;  if(doC>25)  {  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_0,GPIO\_PIN\_SET);  }else  {  HAL\_GPIO\_WritePin(GPIOD,GPIO\_PIN\_0,GPIO\_PIN\_RESET);  }  }  } |

**MỤC LỤC**

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