

LAMPIRAN

1. Program Arduino (TX)

```
int a,b,c,d,e,f;
void setup() {
  Serial.begin(200000);
  pinMode(9, INPUT_PULLUP);
  pinMode(12, INPUT_PULLUP);
  pinMode(11, INPUT_PULLUP);
  pinMode(10, INPUT_PULLUP);
  pinMode(8, INPUT);
}
void loop() {
  while( digitalRead(8) == LOW){
    int bt1 = digitalRead(9);
    int bt2 = digitalRead(12);
    int bt3 = digitalRead(11);
    int bt4 = digitalRead(10);
    if (bt1 == LOW){
      Serial.println("|"); }
    if (bt2 == LOW){
      Serial.println("|");
      Serial.println("z");
      delay(300); }
    if (bt3 == LOW){
      Serial.println("y");
      delay(300); }
```

```
if (bt4 == LOW) {  
    Serial.println("x");  
    delay(300); }  
  
a = analogRead(A0);  
b = analogRead(A7);  
c = analogRead(A2);  
d = analogRead(A3);  
e = analogRead(A4);  
f = analogRead(A5);  
Serial.print ("A ");  
Serial.println (a);  
Serial.print ("B ");  
Serial.println (b);  
Serial.print ("C ");  
Serial.println (c);  
Serial.print ("D ");  
Serial.println (d);  
Serial.print ("E ");  
Serial.println (e);  
Serial.print ("F ");  
Serial.println (f);  
}  
  
Serial.print ("A ");  
Serial.println (0);  
Serial.print ("B ");  
Serial.println (0);  
Serial.print ("C ");  
Serial.println (0);
```

```

Serial.print ("D ");
Serial.println (0);
Serial.print ("E ");
Serial.println (0);
Serial.print ("F ");
Serial.println (0);
}

```

2. Program Arduino (RX)

```

#include <Adafruit_GFX.h>
#include <MCUFRIEND_kbv.h>
#include <Messenger.h>
Messenger message = Messenger();
MCUFRIEND_kbv TFT;
uint16_t id ;
#define BLACK    0x0000
#define BLUE     0x001F
#define RED      0xF800
#define GREEN    0x07E0
#define CYAN     0x07FF
#define MAGENTA  0xF81F
#define YELLOW   0xFFE0
#define WHITE    0xFFFF
#define GRAY     0x18C3
int lastb=0;
int LastTime=0;
int ThisTime;
bool BPMTiming=false;
bool BeatComplete=false;

```

```
int BPM=0;

#define UpperThreshold 200

#define LowerThreshold 180

int x_pos, x_pos2 = 203;

int up, down, up1, up2, up3, up4, up5, up6, down1,
down2, down3, down4, down5, down6;

int I, II, III, IV, V, VI;//, BPM;

int Lead1;

int Lead1_old;

int Lead2;

int Lead2_old;

int Lead3;

int Lead3_old;

int Lead4;

int Lead4_old;

int Lead5;

int Lead5_old;

int Lead6;

int Lead6_old;

int SLead1;

int SLead1_old;

int SLead2;

int SLead2_old;

int SLead3;

int SLead3_old;

int SLead4;

int SLead4_old;

int SLead5;

int SLead5_old;

int SLead6;
```

```
int SLead6_old;
int c_lead = 1;
int x_scale = 2;
int grid = 0;
int y_scale = 2;
void Reset() {
    x_pos = 1;
    x_pos2 = 201;
    TFT.reset();
    id = TFT.readID();
    TFT.begin(id);
    TFT.setRotation(3);
    TFT.fillScreen(BLACK);
}
void yscale() {
    if (c_lead >= 1 || c_lead <= 3) {
        if (y_scale == 2) {
            up1 = 26; down1 = 75;
            up2 = 126; down2 = 175;
            up3 = 226; down3 = 275;
            up4 = 26; down4 = 75;
            up5 = 126; down5 = 175;
            up6 = 226; down6 = 275;
        }
        if (y_scale == 4) {
            up1 = 1; down1 = 101;
            up2 = 103; down2 = 203;
            up3 = 205; down3 = 305;
            up4 = 1; down4 = 101;
        }
    }
}
```

```
        up5 = 103; down5 = 203;
        up6 = 205; down6 = 305;
    }
}
if (c_lead >= 4 || c_lead <= 9) {
    if (y_scale == 2) {
        up = 76; down = 176;
    }
    if (y_scale == 4) {
        up = 26; down = 226;
    }
}
}
void disp1() {
    TFT.setTextColor(WHITE); TFT.setTextSize(1);
    TFT.setCursor(10, 309); TFT.print("YONNA
YULIANT");
    TFT.setCursor(100, 309);
    TFT.print("(20163010029)");

    TFT.setTextColor(WHITE); TFT.setTextSize(2);
    TFT.setCursor(415, 20); TFT.print("BPM :");
}
void disp2() {
    TFT.drawFastHLine(0, 251, 480, WHITE);
    TFT.setTextColor(WHITE); TFT.setTextSize(1);
    TFT.setCursor(10, 309); TFT.print("YONNA
YULIANT");
```

```
TFT.setCursor(100, 309);
TFT.print("(20163010029)");

TFT.setTextColor(WHITE); TFT.setTextSize(2);
TFT.setCursor(15, 256); TFT.print("BPM :");
}

void bpm1() {
  if (x_pos == 15 || x_pos == 85 || x_pos == 165 ||
x_pos == 250 || x_pos == 320) {
    TFT.fillRect(415, 40, 50, 40, BLACK);
    TFT.setTextColor(WHITE); TFT.setTextSize(2);
    TFT.setCursor(415, 40); TFT.print(BPM);
  }
}

void bpm2() {
  if (x_pos == 15 || x_pos == 250 || x_pos == 350
|| x_pos == 450) {
    TFT.fillRect(80, 256, 50, 40, BLACK);
    TFT.setTextColor(WHITE); TFT.setTextSize(2);
    TFT.setCursor(80, 256); TFT.print(BPM);
  }
}

void setup() {
  Reset();
  Serial.begin(200000);
  message.attach(messageCompleted);
}
```

```
void messageCompleted() {
    if ( message.checkString("A") ) {
        I = message.readInt();
        Lead1 = map(I, 0, 1023, down1, up1);
        SLead1 = map(I, 0, 1023, down, up);
    }
    if ( message.checkString("B") ) {
        II = message.readInt();
        Lead2 = map(II, 0, 1023, down2, up2);
        SLead2 = map(II, 0, 1023, down, up);
    }
    if ( message.checkString("C") ) {
        III = message.readInt();
        Lead3 = map(III, 0, 1023, down3, up3);
        SLead3 = map(III, 0, 1023, down, up);
    }
    if ( message.checkString("D") ) {
        IV = message.readInt();
        Lead4 = map(IV, 0, 1023, down4, up4);
        SLead4 = map(IV, 0, 1023, down, up);
    }
    if ( message.checkString("E") ) {
        V = message.readInt();
        Lead5 = map(V, 0, 1023, down5, up5);
        SLead5 = map(V, 0, 1023, down, up);
    }
    if ( message.checkString("F") ) {
        VI = message.readInt();
        Lead6 = map(VI, 0, 1023, down6, up6);
    }
}
```



```
SLead6 = map(VI, 0, 1023, down, up);
}
if ( message.checkString("|") ) {
    Reset();
}
if ( message.checkString("x") ) {
    x_scale = x_scale + 2;
    if (x_scale >= 5) {
        x_scale = 2;
    }
}
if ( message.checkString("y") ) {
    y_scale++;
    if (y_scale >= 5) {
        y_scale = 2;
    }
}
if ( message.checkString("z") ) {
    c_lead++;
    if (c_lead >= 10) {
        c_lead = 1;
    }
}
}
```

```
void AllLead() {
    bpm1();
    if (x_pos <= 201) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(190, 5); TFT.print("I");
        TFT.drawLine(x_pos - x_scale, Lead1_old,
            x_pos, Lead1, GREEN);
        Lead1_old = Lead1;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(185, 107); TFT.print("II");
        TFT.drawLine(x_pos - x_scale, Lead2_old,
            x_pos, Lead2, RED);
        Lead2_old = Lead2;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(179, 209); TFT.print("III");
        TFT.drawLine(x_pos - x_scale, Lead3_old,
            x_pos, Lead3, BLUE);
        Lead3_old = Lead3;
        TFT.fillRect(x_pos + 1, 0, x_scale, 306,
            BLACK);
    }
    if (x_pos2 <= 403) {
        x_pos2 += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(378, 5); TFT.print("AVR");
        TFT.drawLine(x_pos2 - x_scale, Lead4_old,
            x_pos2, Lead4, YELLOW);
        Lead4_old = Lead4;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(378, 107); TFT.print("AVL");
    }
}
```

```

    TFT.drawLine(x_pos2 - x_scale, Lead5_old,
x_pos2, Lead5, MAGENTA);
Lead5_old = Lead5;
TFT.setTextColor(YELLOW); TFT.setTextSize(1);
TFT.setCursor(378, 209); TFT.print("AVF");
    TFT.drawLine(x_pos2 - x_scale, Lead6_old,
x_pos2, Lead6, CYAN);
Lead6_old = Lead6;
    TFT.fillRect(x_pos2 + 1, 0, x_scale, 306,
BLACK);
}
if (x_pos >= 200 || x_pos2 >= 402) {
    x_pos = (1 + x_scale);
    x_pos2 = (203 + x_scale);
    TFT.fillRect(0, 0, x_scale + (x_scale + 2),
306 , BLACK);
    TFT.fillRect(202, 0, x_scale + (x_scale + 2),
306, BLACK);
}
}
void Lead123() {
    bpm1();
    if (x_pos <= 403) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(378, 5); TFT.print("I");
        TFT.drawLine(x_pos - x_scale, Lead1_old,
x_pos, Lead1, GREEN);
        Lead1_old = Lead1;
    }
}

```

```

TFT.setTextColor(YELLOW); TFT.setTextSize(1);
TFT.setCursor(378, 107); TFT.print("II");
    TFT.drawLine(x_pos - x_scale, Lead2_old,
        x_pos, Lead2, RED);
Lead2_old = Lead2;
TFT.setTextColor(YELLOW); TFT.setTextSize(1);
TFT.setCursor(378, 209); TFT.print("III");
    TFT.drawLine(x_pos - x_scale, Lead3_old,
        x_pos, Lead3, BLUE);
Lead3_old = Lead3;
    TFT.fillRect(x_pos + 1, 0, x_scale, 306,
        BLACK);
}
if (x_pos >= 403) {
    x_pos = (1 + x_scale);
    TFT.fillRect(0, 0, x_scale + (x_scale + 2),
        306, BLACK);
}
}
void Lead456() {
    bpm1();
    if (x_pos <= 403) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(378, 5); TFT.print("AVR");
        TFT.drawLine(x_pos - x_scale, Lead4_old,
            x_pos, Lead4, YELLOW);
        Lead4_old = Lead4;
        TFT.setTextColor(YELLOW); TFT.setTextSize(1);
        TFT.setCursor(378, 107); TFT.print("AVL");
    }
}

```

```

    TFT.drawLine(x_pos - x_scale, Lead5_old,
        x_pos, Lead5, MAGENTA);

    Lead5_old = Lead5;

    TFT.setTextColor(YELLOW); TFT.setTextSize(1);
    TFT.setCursor(378, 209); TFT.print("AVF");

    TFT.drawLine(x_pos - x_scale, Lead6_old,
        x_pos, Lead6, CYAN);

    Lead6_old = Lead6;

    TFT.fillRect(x_pos + 1, 0, x_scale, 306,
        BLACK);

}

if (x_pos >= 403) {
    x_pos = (1 + x_scale);

    TFT.fillRect(0, 0, x_scale + (x_scale + 2),
        305 , BLACK);

}

}

void LeadI() {
    bpm2();

    if (x_pos <= 478) {
        x_pos += x_scale;

        TFT.setTextColor(YELLOW); TFT.setTextSize(2);
        TFT.setCursor(465, 5); TFT.print("I");

        TFT.drawLine(x_pos - x_scale, SLead1_old,
            x_pos, SLead1, GREEN);

        TFT.fillRect(x_pos + 1, 0, x_scale, 250,
            BLACK);

        SLead1_old = SLead1;

    }
}

```

```
if (x_pos >= 477) {
    x_pos = (1 + x_scale);
    TFT.fillRect(0, 0, x_scale + (x_scale + 2),
        250, BLACK);
}
}
void LeadII() {
    bpm2();
    if (x_pos <= 478) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(2);
        TFT.setCursor(455, 5); TFT.print("II");
        TFT.drawLine(x_pos - x_scale, SLead2_old,
            x_pos, SLead2, RED);
        TFT.fillRect(x_pos + 1, 0, x_scale, 249,
            BLACK);
        SLead2_old = SLead2;
    }
    if (x_pos >= 477) {
        x_pos = (1 + x_scale);
        TFT.fillRect(0, 0, x_scale + (x_scale + 2),
            250, BLACK);
    }
}
void LeadIII() {
    bpm2();
    if (x_pos <= 478) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(2);
        TFT.setCursor(440, 5); TFT.print("III");
    }
}
```

```
TFT.drawLine(x_pos - x_scale, SLead3_old,
x_pos, SLead3, BLUE);

TFT.fillRect(x_pos + 1, 0, x_scale, 249,
BLACK);

SLead3_old = SLead3;
}

if (x_pos >= 477) {
x_pos = (1 + x_scale);

TFT.fillRect(0, 0, x_scale + (x_scale + 2),
250, BLACK);
}
}

void LeadAVR() {
bpm2();

if (x_pos <= 478) {
x_pos += x_scale;

TFT.setTextColor(YELLOW); TFT.setTextSize(2);
TFT.setCursor(440, 5); TFT.print("AVR");

TFT.drawLine(x_pos - x_scale, SLead4_old,
x_pos, SLead4, YELLOW);

TFT.fillRect(x_pos + 1, 0, x_scale, 249,
BLACK);

SLead4_old = SLead4;
}

if (x_pos >= 477) {
x_pos = (1 + x_scale);

TFT.fillRect(0, 0, x_scale + (x_scale + 2),
250, BLACK);
}
}
}
```

```
void LeadAVL() {
    bpm2();
    if (x_pos <= 478) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(2);
        TFT.setCursor(440, 5); TFT.print("AVL");
        TFT.drawLine(x_pos - x_scale, SLead5_old,
            x_pos, SLead5, MAGENTA);
        TFT.fillRect(x_pos + 1, 0, x_scale, 249,
            BLACK);
        SLead5_old = SLead5;
    }
    if (x_pos >= 477) {
        x_pos = (1 + x_scale);
        TFT.fillRect(0, 0, x_scale + (x_scale + 2),
            250, BLACK);
    }
}

void LeadAVF() {
    bpm2();
    if (x_pos <= 478) {
        x_pos += x_scale;
        TFT.setTextColor(YELLOW); TFT.setTextSize(2);
        TFT.setCursor(440, 5); TFT.print("AVF");
        TFT.drawLine(x_pos - x_scale, SLead6_old,
            x_pos, SLead6, CYAN);
        TFT.fillRect(x_pos + 1, 0, x_scale, 249,
            BLACK);
        SLead6_old = SLead6;
    }
}
```



```
if (x_pos >= 477) {
    x_pos = (1 + x_scale);
    TFT.fillRect(0, 0, x_scale + (x_scale + 2),
        250, BLACK);
}
}
void Leads() {
    if (c_lead == 1) {
        disp1();
        AllLead();
    }
    if (c_lead == 2) {
        disp1();
        Lead123();
    }
    if (c_lead == 3) {
        disp1();
        Lead456();
    }
    if (c_lead == 4) {
        disp2();
        LeadI();
    }
    if (c_lead == 5) {
        disp2();
        LeadII();
    }
}
```

```
if (c_lead == 6) {
    disp2();
    LeadIII();
}
if (c_lead == 7) {
    disp2();
    LeadAVR();
}
if (c_lead == 8) {
    disp2();
    LeadAVL();
}
if (c_lead == 9) {
    disp2();
    LeadAVF();
}
}
void loop() {

    while ( Serial.available() ) {
        message.process( Serial.read() );
    }
    HeartRate();
    yscale();
    Leads();
}
```

```
void HeartRate(){
  ThisTime=millis();
  int value=analogRead(7);
  if(value>UpperThreshold)
  {
    if(BeatComplete)
    {
      BPM=ThisTime-LastTime;
      BPM=int(60/(float(BPM)/1000));
      BPMTiming=false;
      BeatComplete=false;
    }
    if(BPMTiming==false)
    {
      LastTime=millis();
      BPMTiming=true;
    }
  }
  if((value<LowerThreshold) & (BPMTiming))
  BeatComplete=true;
}
```