LAMPIRAN

Pembuatan program mikrokontroller dan Delphi

a. Program mikrokontroller sebagai pengirim sinyal (*transmitter*) untuk blok-1

```
#include <nRF24L01.h>
#include <printf.h>
#include <RF24.h>
#include <RF24_config.h>
RF24 transmit (9,10);
byte address [6] = "00001";
float tekanan1,tekanan2,tekanan3,tekanan4;
int int_tekanan1, int_tekanan2, int_tekanan3,
int_tekanan4;
char data[32];
int i=0;
int nilai1,nilai2,nilai3,nilai4;
int sensor1 = A0;       //analog 0
int sensor2 = A1;       //analog 1
int sensor3 = A2;       //analog 2
int sensor4 = A3;       //analog 3
const int PIN_4 = 4;
const int PIN_5 = 5;
const int PIN_6 = 6;
const int PIN_7 = 7;
const int PIN_8 = 8;
void setup() {
  Serial.begin(9600);
    transmit.begin();
  transmit.openWritingPipe(address);
  transmit.setPALevel(RF24_PA_MAX);
  transmit.setDataRate(RF24_250KBPS);
transmit.setChannel(100);
transmit.stopListening();
    pinMode (PIN_4, OUTPUT);
    pinMode (PIN_5, OUTPUT);
    pinMode (PIN_6, OUTPUT);
    pinMode (PIN_7, OUTPUT);
    pinMode (PIN_8, OUTPUT);}
void loop()
{  i=0;
  for (i=0;i<10;i++);
```

```
{    nilai1 = analogRead ( sensor1 );
      nilai2 = analogRead ( sensor2 );
    nilai3 = analogRead ( sensor3 );
    nilai4 = analogRead ( sensor4 ); }
nilai1 = nilai1 /10;
nilai2 = nilai2 /10;
nilai3 = nilai3 /10;
nilai4 = nilai4 /10;
  Serial.print ( "sensor1 = " );
  Serial.println (nilai1);
  Serial.print ( "sensor2 = " );
  Serial.println (nilai2);
  Serial.print ( "sensor3 = " );
  Serial.println (nilai3);
  Serial.print ( "sensor4 = " );
  Serial.println (nilai4);
    tekanan1 = nilai1*10;
  tekanan2 = nilai2*10;
  tekanan3 = nilai3*10;
  tekanan4 = nilai4*10;
    int_tekanan1 = (int) tekanan1;
  int_tekanan2 = (int) tekanan2;
  int_tekanan3 = (int) tekanan3;
  int_tekanan4 = (int) tekanan4;
   if (tekanan1>=390 && tekanan1<=488)
    {      digitalWrite (PIN_5, LOW);
    }else{digitalWrite (PIN_5, HIGH);}
    if (tekanan2>=382 && tekanan2<=460)
     {      digitalWrite (PIN_6, LOW);
     }else{digitalWrite (PIN_6, HIGH);}
    if (tekanan3>=360 && tekanan3<=440)
     {      digitalWrite (PIN_7, LOW);
     }else{digitalWrite (PIN_7, HIGH);}
    if (tekanan4>=100 && tekanan4<=145)
     {      digitalWrite (PIN_8, LOW);
     }else{digitalWrite (PIN_8, HIGH);}
String send_data = (String) "a"+int_tekanan1+"b"+"c"+
int_tekanan2+"d"+"e"+int_tekanan3+"f"+"g"+int_tekanan4+
"h";
  send_data.toCharArray(data,32);
  transmit.write(&data,sizeof(data));   //transmit data
  delay(500); }
```

b. Program mikrokontroller sebagai pengirim sinyal (*transmitter*) untuk blok-2

```
#include <nRF24L01.h>
#include <printf.h>
#include <RF24.h>
#include <RF24_config.h>
RF24 transmit (9,10);
byte address [6] = "00001";
float tekanan1,tekanan2,tekanan3,tekanan4;
int int_tekanan1, int_tekanan2, int_tekanan3,
int_tekanan4;
char data[32];
int i=0;
int nilai1,nilai2,nilai3,nilai4;
int sensor1 = A0;      //analog 0
int sensor2 = A1;      //analog 1
int sensor3 = A2;      //analog 2
int sensor4 = A3;      //analog 3
const int PIN_4 = 4;
const int PIN_5 = 5;
const int PIN_6 = 6;
const int PIN_7 = 7;
const int PIN_8 = 8;
void setup() {
  Serial.begin(9600);
    transmit.begin();
  transmit.openWritingPipe(address);
  transmit.setPALevel(RF24_PA_MAX);
  transmit.setDataRate(RF24_250KBPS);
  transmit.setChannel(100);
  transmit.stopListening();
    pinMode (PIN_4, OUTPUT);
    pinMode (PIN_5, OUTPUT);
    pinMode (PIN_6, OUTPUT);
    pinMode (PIN_7, OUTPUT);
    pinMode (PIN_8, OUTPUT);    }
void loop(){  i=0;
  for (i=0;i<10;i++);
  {   nilai1 = analogRead ( sensor1 );
   nilai2 = analogRead ( sensor2 );
   nilai3 = analogRead ( sensor3 );
   nilai4 = analogRead ( sensor4 );}
nilai1 = nilai1 /10;
nilai2 = nilai2 /10;
nilai3 = nilai3 /10;
nilai4 = nilai4 /10;
```

```
  Serial.print ( "sensor1 = " );
  Serial.println (nilai1);
   Serial.print ( "sensor2 = " );
  Serial.println (nilai2);
   Serial.print ( "sensor3 = " );
  Serial.println (nilai3);
   Serial.print ( "sensor4 = " );
  Serial.println (nilai4);
    tekanan1 = nilai1*10;
  tekanan2 = nilai2*10;
  tekanan3 = nilai3*10;
  tekanan4 = nilai4*10;
    int_tekanan1 = (int) tekanan1;
  int_tekanan2 = (int) tekanan2;
  int_tekanan3 = (int) tekanan3;
  int_tekanan4 = (int) tekanan4;
   if (tekanan1>=390 && tekanan1<=480)
    {       digitalWrite (PIN_5, LOW);
    }else{digitalWrite (PIN_5, HIGH);}
    if (tekanan2>=372 && tekanan2<=450)
     {       digitalWrite (PIN_6, LOW);
     }else{digitalWrite (PIN_6, HIGH);}
    if (tekanan3>=360 && tekanan3<=438)
     {       digitalWrite (PIN_7, LOW);
     }else{digitalWrite (PIN_7, HIGH);}
    if (tekanan4>=100 && tekanan4<=145)
     {       digitalWrite (PIN_8, LOW);
     }else{digitalWrite (PIN_8, HIGH);}
    String send_data = (String)
"i"+int_tekanan1+"j"+"k"+
int_tekanan2+"l"+"m"+int_tekanan3+"n"+"o"+
int_tekanan4+"p";
  send_data.toCharArray(data,32);
  transmit.write(&data,sizeof(data));
  delay(500);   }
```

c. Program mikrokontroller sebagai penerima sinyal *(receiver).*

```
#include <nRF24L01.h>
#include <printf.h>
#include <RF24.h>
#include <RF24_config.h>
RF24 receive (10,9);
byte address [5] = "00001";
```

```
void setup() {
  Serial.begin(9600);
  Serial.print("receiver\n");
  receive.begin();
  receive.openReadingPipe(0,address);
  receive.setPALevel(RF24_PA_MAX);
  receive.setDataRate(RF24_250KBPS);
  receive.setChannel(100);
  receive.startListening(); }
void loop() {
  receive.openReadingPipe(0,address);
  while (receive.available())
  {    char data[32];
    receive.read(&data, sizeof(data));
    Serial.println(data);
    delay (500);}}
```

d. Program untuk tampilan Delphi pada komputer.

```
unit Unit1;
interface
uses
  Windows, Messages, SysUtils, Variants, Classes,
Graphics, Controls, Forms,
  Dialogs, StdCtrls, CPort, MMSystem;
type
  TForm1 = class(TForm)
    Label1: TLabel;
    Label2: TLabel;
    Label3: TLabel;
    Label4: TLabel;
    Edit1: TEdit;
    Edit2: TEdit;
    Edit3: TEdit;
    Edit4: TEdit;
    Edit5: TEdit;
    Edit6: TEdit;
    Edit7: TEdit;
    Edit8: TEdit;
    Label5: TLabel;
    Label6: TLabel;
    Label7: TLabel;
```

```
    Label8: TLabel;
    Label9: TLabel;
    Label10: TLabel;
    Label11: TLabel;
    ComPort1: TComPort;
    ComDataPacketOksigen1: TComDataPacket;
    ComDataPacketN2o1: TComDataPacket;
    Button1: TButton;
    ComDataPacketUdara1: TComDataPacket;
    ComDataPacketVaccum1: TComDataPacket;
    ComDataPacketOksigen2: TComDataPacket;
    ComDataPacketN2o2: TComDataPacket;
    ComDataPacketUdara2: TComDataPacket;
    ComDataPacketVaccum2: TComDataPacket;
    procedure ComDataPacketOksigen1Packet(Sender:
TObject; const Str: String);
    procedure ComDataPacketN2o1Packet(Sender: TObject;
const Str: String);
    procedure Button1Click(Sender: TObject);
    procedure ComDataPacketUdara1Packet(Sender:
TObject; const Str: String);
    procedure ComDataPacketVaccum1Packet(Sender:
TObject; const Str: String);
    procedure ComDataPacketOksigen2Packet(Sender:
TObject;
      const Str: String);
    procedure ComDataPacketN2o2Packet(Sender: TObject;
const Str: String);
    procedure ComDataPacketUdara2Packet(Sender:
TObject;
      const Str: String);
    procedure ComDataPacketVaccum2Packet(Sender:
TObject;
      const Str: String);
  private
    { Private declarations }
oksigen1,oksigen2,datao21,dataoksigen2,n2o1,n2o2,datan2
o1,datan2o2,udara1,udara2,dataudara1,dataudara2,vaccum1
,vaccum2,datavaccum1,datavaccum2:Double;
  public
    { Public declarations }
```

```
  end;
var
  Form1: TForm1;
implementation
{$R *.dfm}
procedure TForm1.ComDataPacketOksigen1Packet(Sender:
TObject; const Str: String);
begin
  if str<>'' then
  begin
  oksigen1:=strtoint(str);
  datao21:=(oksigen1/88.5);
  edit1.Text:=formatfloat('0.#',datao21);
    end;
end;
procedure TForm1.ComDataPacketN2o1Packet(Sender:
TObject; const Str: String);
begin
   if str<>'' then
  begin
  n2o1:=strtoint(str);
  datan2o1:=(n2o1/85.5);
  edit2.Text:=formatfloat('0.#',datan2o1);
    end;
end;
procedure TForm1.Button1Click(Sender: TObject);
begin
comport1.ShowSetupDialog;
 comport1.Open;
end;
procedure TForm1.ComDataPacketUdara1Packet(Sender:
TObject; const Str: String);
begin
     if str<>'' then
  begin
 udara1:=strtoint(str);
  dataudara1:=(udara1/92);
  edit3.Text:=formatfloat('0.#',dataudara1);
    end;
end;
```
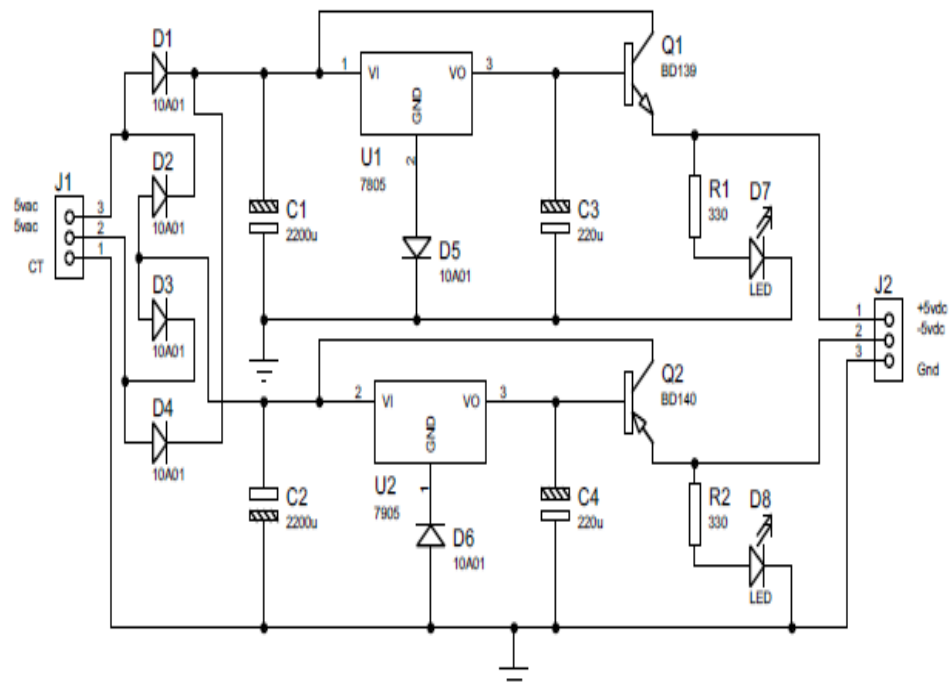
```
procedure TForm1.ComDataPacketVaccum1Packet(Sender:
TObject; const Str: String);
begin
     if str<>'' then
  begin
  vaccum1:=strtoint(str);
  datavaccum1:=(vaccum1/2.34);
  edit4.Text:=formatfloat('0.#',datavaccum1);
    end;
end;
procedure TForm1.ComDataPacketOksigen2Packet(Sender:
TObject;
   const Str: String);
begin
       if str<>'' then
  begin
  oksigen2:=strtoint(str);
  dataoksigen2:=(oksigen2/90);
  edit5.Text:=formatfloat('0.#',dataoksigen2);
    end;
end;
procedure TForm1.ComDataPacketN2o2Packet(Sender:
TObject;
   const Str: String);
begin
           if str<>'' then
  begin
  n2o2:=strtoint(str);
  datan2o2:=(n2o2/86);
  edit6.Text:=formatfloat('0.#',datan2o2);
    end;
end;
procedure TForm1.ComDataPacketUdara2Packet(Sender:
TObject;
   const Str: String);
begin
     if str<>'' then
  begin
   udara2:=strtoint(str);
   dataudara2:=(udara2/93);
   edit7.Text:=formatfloat('0.#',dataudara2);
```
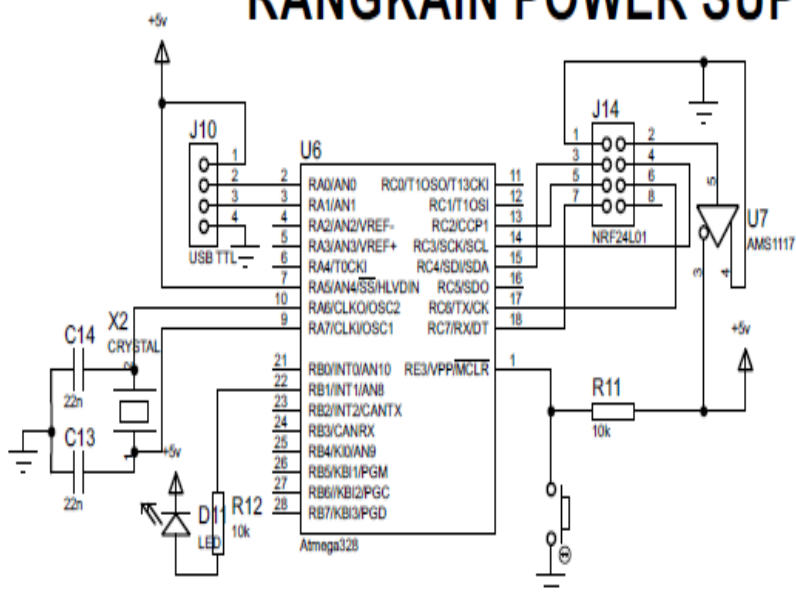
```
    end;
end;
procedure TForm1.ComDataPacketVaccum2Packet(Sender:
TObject;
  const Str: String);
begin
            if str<>'' then
  begin
  vaccum2:=strtoint(str);
  datavaccum2:=(vaccum2/2.34);
  edit8.Text:=formatfloat('0.#',datavaccum2);
end;
end;
end.
```
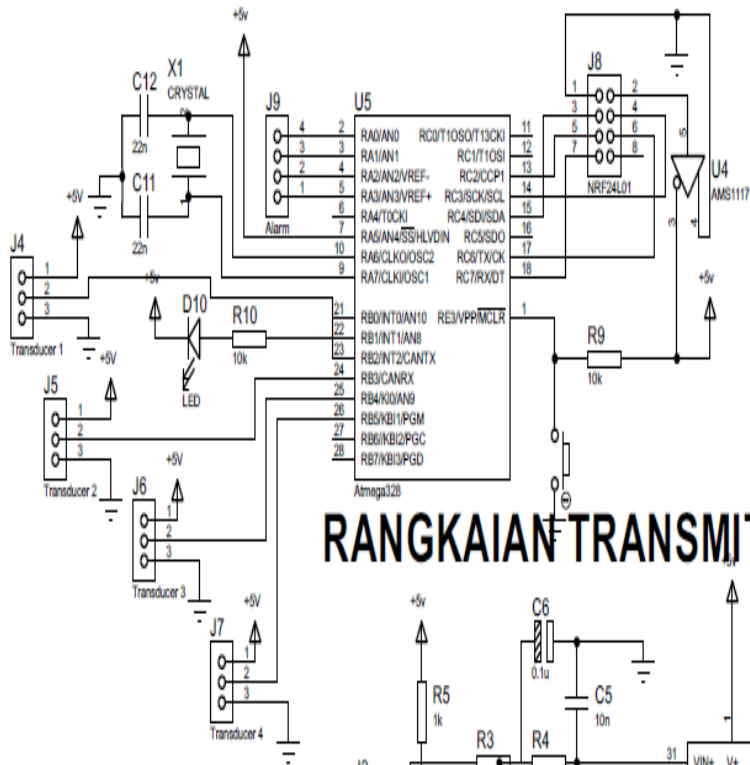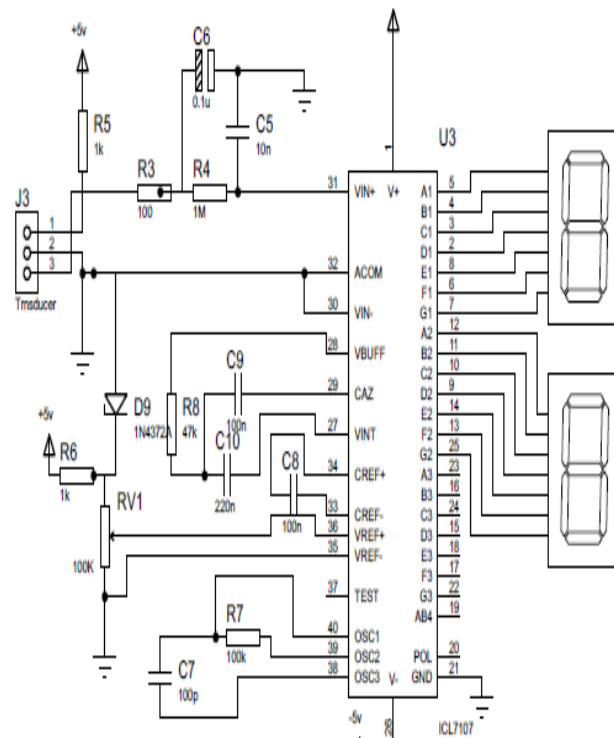
LAMPIRAN GAMBAR SKEMATIK

RANGKAIN POWER SUPLAY

RANGKAIAN RECEIVER

RANGKAIAN TRANSMITER

RANGKAIAN SEVEN SEGMENT

C12
X1
CRYSTAL
22n
C11
22n
+5V
+5v

J9
4
3
2
1
Alarm

U5
2 RA0/AN0   RC0/T1OSO/T13CKI 11
3 RA1/AN1   RC1/T1OSI   12
4 RA2/AN2/VREF- RC2/CCP1   13
5 RA3/AN3/VREF+ RC3/SCK/SCL   14
6 RA4/T0CKI   RC4/SDI/SDA   15
7 RA5/AN4/SS/HLVDIN RC5/SDO   16
10 RA6/CLKO/OSC2 RC6/TX/CK   17
9 RA7/CLKI/OSC1 RC7/RX/DT   18

21 RB0/INT0/AN10 RE3/VPP/MCLR   1
22 RB1/INT1/AN8
23 RB2/INT2/CANTX
24 RB3/CANRX
25 RB4/KI0/AN9
26 RB5/KBI1/PGM
27 RB6/KBI2/PGC
28 RB7/KBI3/PGD
Atmega328

J8
1 2
3 4
5 6
7 8
NRF24L01

U4
AMS1117

J4
1
2
3
Transducer 1

D10
LED
R10
10k

+5V

R9
10k

J5
1
2
3
Transducer 2

J6
1
2
3
Transducer 3

+5V

J7
1
2
3
Transducer 4

+5v

J3
1
2
3
Trnsducer

R5
1k

C6
0.1u
C5
10n

U3
31 VIN+   V+
A1 5
B1 4
C1 3
D1 8
E1 6
F1 7
G1 2

32 ACOM
30 VIN-
28 VBUFF
A2 12
B2 11
C2 10
D2 9
E2 14
F2 13
G2 25

R3
100
R4
1M

D9
1N4372A
R8
47k
C9
100n

29 CAZ
27 VINT
34 CREF+

+5v
R6
1k

C10
220n
C8
100n

33 CREF-
36 VREF+
35 VREF-

A3 23
B3 16
C3 24
D3 15
E3 18
F3 17
G3 22
AB4 19

RV1
100K

37 TEST
R7
100k
40 OSC1
39 OSC2
38 OSC3 V-

20 POL
21 GND
ICL7107

C7
100p

-5v

Foto tampilan fisik alat sentralisasi monitoring tekanan gas medis berbasis Atmega 328.

1. Foto alat simulasi instalasi gas medis dan vakum medis.

2. Foto simulasi bok panel *pressure transducer* dan pemasangan kabel sinyal.
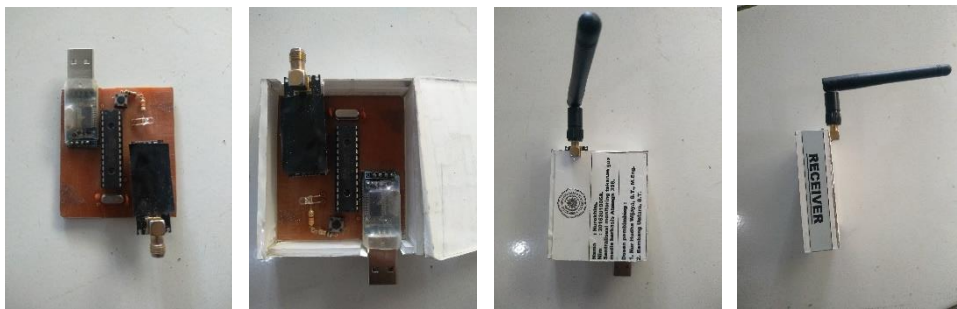

3. Foto tekanan gas medis dan vakum medis tampilan *seven segment.*

4. Foto tekanan gas medis dan vakum medis tampilan komputer.

5. Foto alat penerima sinyal (*Receiver*).

6. Foto perakitan