**Kode Program “Unit Coordinator”**

Menggunakan Arduino IDE-0022

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| #include <NewSoftSerial.h>  NewSoftSerial xbee (13,12);  int packet[22];  void setup()  {  Serial.begin(9600);  xbee.begin(9600);  }  void loop() {  int sX, sY, sZ;  while (xbee.available() > 0) {  int b = readByte();  if (b == 0x7E) {  packet[0] = b;  packet[1] = readByte();  packet[2] = readByte();  int Length = ((packet[1] << 8) | packet[2]);  for(int i=1;i<=(Length+1);i++) {  packet[2+i] = readByte();  }  // printPacket(Length+4);  int frametype = packet[3];  if (frametype == 0x81) {  int router = (packet[4] << 8) | packet[5];  Serial.print("Router : ");  Serial.println(router,HEX);  int RSSI = packet[6];  Serial.print("RSSI :");  Serial.println(RSSI, HEX);  int hour = packet[8];  int minute = packet[9];  int second = packet[10];  int dayOfMonth = packet[11];  int month = packet[12];  int year = packet[13];  Serial.print(hour,DEC);  Serial.print(":");  Serial.print(minute,DEC);  Serial.print(":");  Serial.print(second,DEC);  Serial.print(" ");  Serial.print(dayOfMonth,DEC);  Serial.print("/");  Serial.print(month,DEC);  Serial.print("/");  Serial.println(year,DEC);    if (packet[14] == 0x00){  sX = packet[15] ; }  if (packet[14] == 0xff){  sX = packet [15]\*(-1);}  if (packet[16] == 0x00){  sY = packet[17] ; }  if (packet[16] == 0xff){  sY = packet [17]\*(-1);}  if (packet[18] == 0x00){  sZ = packet[19] ; }  if (packet[18] == 0xff){  sZ = packet [19]\*(-1);}  Serial.print("Perpindahan X :");  Serial.println(sX,DEC);  Serial.print("Perpindahan Y :");  Serial.println(sY,DEC);  Serial.print("Perpindahan Z :");  Serial.println(sZ,DEC);  Serial.println();  }  }  }  }  void printPacket(int l) {  for(int i=0;i < l;i++) {  if (packet[i] < 0xF) {  Serial.print(0);  }  Serial.print(packet[i], HEX);  Serial.print(" ");  }  Serial.println("");  }  int readByte() {  while (true) {  if (xbee.available() > 0) {  return xbee.read();  }  }  } |

**Kode Program “Unit Router”**

Menggunakan Arduino IDE-0022

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| #include <XBee.h>  #include <Wire.h>  #define DS1307\_I2C\_ADDRESS 0x68 //set rtc  XBee xbee = XBee();  uint8\_t payload[13] ;//= { 0, 0, 0, 0, 0, 0, 0, 0 };  XBeeAddress64 addr64 = XBeeAddress64(0x0013a200, 0x406e7e63);  Tx64Request tx = Tx64Request(addr64, payload, sizeof(payload));  TxStatusResponse txStatus = TxStatusResponse();  byte second, minute, hour, dayOfWeek, dayOfMonth, month, year, tmp;  float Xawal,Yawal,Zawal=0.00;  int packet[30];  int statusLed = 13;  int errorLed = 12;  int Dio = 4 ;  int Clk = 5 ;  int Cs = 6 ;  uint8\_t byteDx, byteDy, byteDz;  word data;  int dValue[12] = {0,0,0,0,0,0,0,0,0,0,0,0,};  float res,res0;  float Vx, Vy, Vz, Dx, Dy, Dz = 0;  float accelX, accelY, accelZ;  const int zeros = 10;  const int poles = 10;  float accelXInput[zeros + 1], accelXOutput[poles + 1];  float accelYInput[zeros + 1], accelYOutput[poles + 1];  float accelZInput[zeros + 1], accelZOutput[poles + 1];  /\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* decimal ke bcd \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  byte decToBcd(byte val){  return ( (val/10\*16) + (val%10) );  }  /\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* BCD ke Desimal \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  byte bcdToDec(byte val){  return ( (val/16\*10) + (val%16) );  }  /\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Baca data RTC \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  void getDateDs1307(byte \*second,byte \*minute,byte \*hour,byte \*dayOfWeek,byte \*dayOfMonth,byte \*month,byte \*year){  Wire.beginTransmission(DS1307\_I2C\_ADDRESS);  Wire.send(0);  Wire.endTransmission();  Wire.requestFrom(DS1307\_I2C\_ADDRESS, 7);  \*second = bcdToDec(Wire.receive() & 0x7f);  \*minute = bcdToDec(Wire.receive());  \*hour = bcdToDec(Wire.receive() & 0x3f);  \*dayOfWeek = bcdToDec(Wire.receive());  \*dayOfMonth = bcdToDec(Wire.receive());  \*month = bcdToDec(Wire.receive());  \*year = bcdToDec(Wire.receive());  }  /\*\*\*\*\*\*\*\*\*\*\*\*\* indikator led \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  void flashLed(int pin, int times, int wait) {    for (int i = 0; i < times; i++) {  digitalWrite(pin, HIGH);  delay(wait);  digitalWrite(pin, LOW);  if (i + 1 < times) {  delay(wait);  }  }  }  /\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  void printPacket(int l) {  for(int i=0;i < l;i++) {  if (packet[i] < 0xF) {  Serial.print(0);  }  Serial.print(packet[i], HEX);  }  Serial.println("");  }  //========sub routin pengambilan data percepatan =======//  int getH48C(int D1,int D0){  digitalWrite(Cs, LOW);  pinMode(Dio, OUTPUT);  //\*\*\*1  digitalWrite(Clk, LOW);  digitalWrite(Dio, HIGH);  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*2  digitalWrite(Clk, LOW);  digitalWrite(Dio, LOW);  digitalWrite(Dio, HIGH);//singgle Dio = 1  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*3  digitalWrite(Clk, LOW);  digitalWrite(Dio, LOW);// D2 = 0  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*4  digitalWrite(Clk, LOW);  if (D1==0){ digitalWrite(Dio, LOW);}  else{ digitalWrite(Dio, HIGH);}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*5  digitalWrite(Clk, LOW);  if (D0==0){ digitalWrite(Dio, LOW);}  else{ digitalWrite(Dio, HIGH);}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*6  digitalWrite(Clk, LOW);  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*7  pinMode(Dio, INPUT);  digitalWrite(Clk, LOW);  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*8  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[11]= 1 ;}  else {  dValue[11]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*9  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[10]= 1 ;}  else {  dValue[10]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*10  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[9]= 1 ;}  else {  dValue[9]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*11  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[8]= 1 ;}  else {  dValue[8]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*12  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[7]= 1 ;}  else {  dValue[7]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*13  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[6]= 1 ;}  else {  dValue[6]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*14  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[5]= 1 ;}  else {  dValue[5]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*15  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[4]= 1 ;}  else {  dValue[4]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*16  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[3]= 1 ;}  else {  dValue[3]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*17  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[2]= 1 ;}  else {  dValue[2]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*18  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[1]= 1 ;}  else {  dValue[1]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  //\*\*\*19  digitalWrite(Clk, LOW);  if (digitalRead(Dio)==HIGH){  dValue[0]= 1 ;}  else {  dValue[0]= 0 ;}  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  delayMicroseconds(50);  data = (dValue[11]\*2048)+(dValue[10]\*1024)+(dValue[9]\*512)+(dValue[8]\*256)+(dValue[7]\*128)+(dValue[6]\*64)+(dValue[5]\*32)+(dValue[4]\*16)+(dValue[3]\*8)+(dValue[2]\*4)+(dValue[1]\*2)+(dValue[0]\*1);  digitalWrite(Cs,HIGH);  return data;  }  //=======Sub Routine Filter IIR =================//  float IIR(float value, float xv[], float yv[]) {  xv[0] = xv[1];  xv[1] = xv[2];  xv[2] = xv[3];  xv[3] = xv[4];  xv[4] = xv[5];  xv[5] = xv[6];  xv[6] = xv[7];  xv[7] = xv[8];  xv[8] = xv[9];  xv[9] = xv[10];  xv[10] = value / 5.681713320e+05;  yv[0] = yv[1];  yv[1] = yv[2];  yv[2] = yv[3];  yv[3] = yv[4];  yv[4] = yv[5];  yv[5] = yv[6];  yv[6] = yv[7];  yv[7] = yv[8];  yv[8] = yv[9];  yv[9] = yv[10];  yv[10] = (xv[0] + xv[10]) + 10 \* (xv[1] + xv[9]) + 45 \* (xv[2] + xv[8])  + 120 \* (xv[3] + xv[7]) + 210 \* (xv[4] + xv[6]) + 252 \* xv[5]  + ( -0.0084477842 \* yv[0]) + ( 0.1250487070 \* yv[1])  + ( -0.8452516757 \* yv[2]) + ( 3.4397583115 \* yv[3])  + ( -9.3457158590 \* yv[4]) + ( 17.7418428080 \* yv[5])  + (-23.8769055880 \* yv[6]) + ( 22.5422166190 \* yv[7])  + (-14.3254341650 \* yv[8]) + ( 5.5510863543 \* yv[9]);  return yv[10];  }  /\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  void setup() {  pinMode(statusLed, OUTPUT);  pinMode(Clk , OUTPUT);  pinMode(Cs , OUTPUT);  pinMode(errorLed, OUTPUT);  Wire.begin();    digitalWrite(Cs, LOW);  digitalWrite(Clk, LOW);// Reset ACC  delayMicroseconds(50);  digitalWrite(Clk, HIGH);  digitalWrite(Cs, LOW);  delayMicroseconds(50);  xbee.begin(9600);  //Serial.begin(9600);    //=====Ambil 50 sampel sebagai inisialisasi posisi====//  for(int i=0; i<50; i++){  Xawal += (float(getH48C(0,0) - 2048))\*0.0022;  Yawal += (float(getH48C(0,1) - 2048))\*0.0022;  Zawal += (float(getH48C(1,0) - 2048))\*0.0022;  }  Xawal = Xawal/50;  Yawal = Yawal/50;  Zawal = Zawal/50;  }  void loop() {  getDateDs1307(&second, &minute, &hour, &dayOfWeek, &dayOfMonth, &month, &year);  /\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Data Waktu\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/  payload[0] = hour & 0xff;  payload[1] = minute & 0xff;  payload[2] = second & 0xff;  payload[3] = dayOfMonth & 0xff;  payload[4] = month & 0xff;  payload[5] = year & 0xff;  //=============Mengukur Percepatan===============//  float Ax, Ay, Az;  Ax = ((float(getH48C(0,0) - 2048))\*0.0022)-Xawal;  Ay = ((float(getH48C(0,1) - 2048))\*0.0022)-Yawal;  Az = ((float(getH48C(1,0) - 2048))\*0.0022)-Zawal;  //res = sqrt(sq(Ax)+sq(Ay)+sq(Az));  //Ax = Ax - Xawal;  //Ay = Ay - Yawal;  //Az = Az - Zawal;    accelX = IIR(Ax, accelXInput, accelXOutput);  accelY = IIR(Ay, accelYInput, accelYOutput);  accelZ = IIR(Az, accelZInput, accelZOutput);    // ============ hitung kecepatan ==========//  Vx += (accelX \* 0.078);  Vy += (accelY \* 0.078);  Vz += (accelZ \* 0.078);  // =========== hitung perpindahan ========== //  Dx += (Vx \* 0.008);  Dy += (Vy \* 0.008);  Dz += (Vz \* 0.008);  //======konversi float ke uint8\_t============//  if (Dx < 0 ){  byteDx = byte(Dx\*(-100));  payload[6] = 0xff;  payload[7] = byteDx;  }  else {  byteDx = byte(Dx\*100);  payload[6] = 0x00;  payload[7] = byteDx;  }  if (Dy < 0 ){  byteDy = byte(Dy\*(-100));  payload[8] = 0xff;  payload[9] = byteDy;  }  else {  byteDy = byte(Dy\*100);  payload[8] = 0x00;  payload[9] = byteDy;  }  if (Dz < 0 ){  byteDz = byte(Dz\*(-100));  payload[10] = 0xff;  payload[11] = byteDz;  }  else{  byteDz = byte(Dz\*100);  payload[10] = 0x00;  payload[11] = byteDz;  }  payload[12] = 0x00;    //==========routine interupsi================//  noInterrupts();  if((second-tmp == 5) || (second-tmp == -55)){  xbee.send(tx);  for(int i=0; i<20; i++){  Xawal += (float(getH48C(0,0) - 2048))\*0.0022;  Yawal += (float(getH48C(0,1) - 2048))\*0.0022;  Zawal += (float(getH48C(1,0) - 2048))\*0.0022;  }  Xawal = Xawal/20;  Yawal = Yawal/20;  Zawal = Zawal/20;  Vx, Vy, Vz, Dx, Dy, Dz = 0.00;  tmp = second;  }  interrupts();  } |

**Kode Sumber “Program Server”**

Menggunakan Delphi 7

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| unit CekXYZ;  interface  uses  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,  Dialogs, CPort, CPortCtl, StdCtrls, Buttons, ExtCtrls;  type  TForm1 = class(TForm)  ComTerminal1: TComTerminal;  ComPort1: TComPort;  BitBtn1: TBitBtn;  Bevel1: TBevel;  Bevel2: TBevel;  Bevel3: TBevel;  Label1: TLabel;  Label2: TLabel;  Label3: TLabel;  ComLed1: TComLed;  ComLed2: TComLed;  ComLed3: TComLed;  BitBtn2: TBitBtn;  //procedure ComTerminal1Char(Sender: TObject; Ch: Char);  procedure FormCreate(Sender: TObject);  procedure FormClose(Sender: TObject; var Action: TCloseAction);  procedure ComTerminal1StrRecieved(Sender: TObject; var Str: String);  procedure BitBtn1Click(Sender: TObject);  //procedure ComPort1AfterClose(Sender: TObject);  procedure BitBtn2Click(Sender: TObject);  private  { Private declarations }  public  F:textFile;  { Public declarations }  end;  var  Form1: TForm1;  implementation  {$R \*.dfm}  procedure TForm1.FormCreate(Sender: TObject);  begin  ComPort1.ShowSetupDialog;  Form1.Caption:='Accelerometer Tester [connected to '+ComPort1.Port+' ]';  end;  procedure TForm1.FormClose(Sender: TObject; var Action: TCloseAction);  begin  if ComPort1.Connected=true then  begin  ComPort1.Close;  Comport1.Connected:=false;  CloseFile(F);  end  else  begin  Comport1.Close;  ComPort1.Connected:=false;  end;  end;  procedure TForm1.ComTerminal1StrRecieved(Sender: TObject; var Str: String);  begin  write(F,Str);  end;  procedure TForm1.BitBtn1Click(Sender: TObject);  var  str:string;  begin  if Comport1.Connected=false then  begin  str:=timetoStr(now);  str:=stringReplace(str,':','\_',[rfIgnoreCase,rfReplaceAll]);  AssignFile(F,'C:\Users\Dwi Kurniawan\Desktop\Data\_'+str+'.xls');  rewrite(F);  Comport1.Connected:=true;  BitBtn1.Kind:=BkCancel;  ComPort1.WriteStr('D');  BitBtn1.Caption:='Stop';  end  else  begin  BitBtn1.Kind:=BkOK;  BitBtn1.Caption:='Start';  ComPort1.Connected:=false;  CloseFile(F);  end;  end;  {procedure TForm1.ComPort1AfterClose(Sender: TObject);  begin  CloseFile(F);  end; }  procedure TForm1.BitBtn2Click(Sender: TObject);  begin  if Comport1.Connected=false then  begin  Comport1.Connected:=true;  ComPort1.WriteStr('S');  Comport1.Connected:=false;  end  else  begin  ComPort1.WriteStr('S');  Comport1.Connected:=false;  end;  end;  end. |

**Tampilan Form Utama Program Server**

