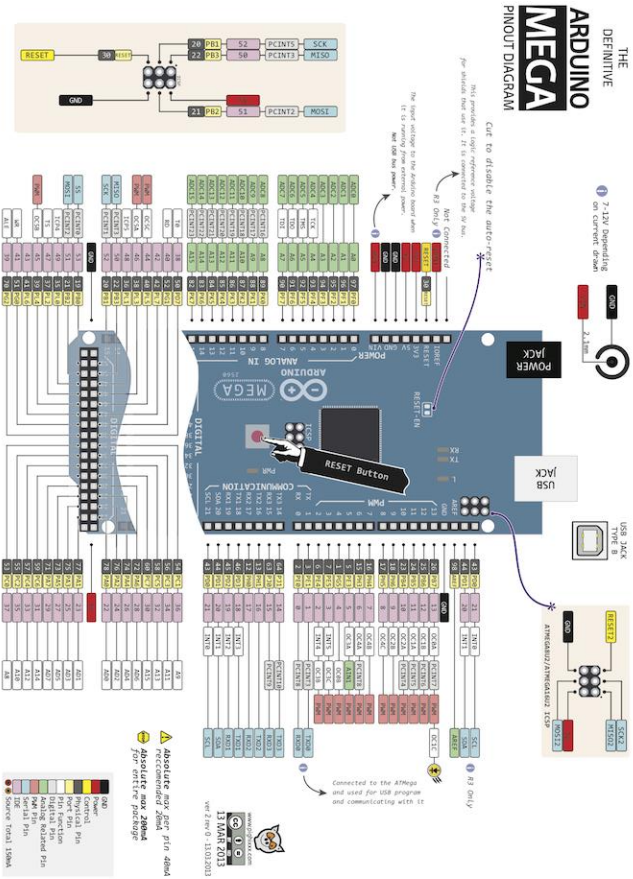
LAMPIRAN

1. Data Sheet Arduino Mega

Board Arduino Mega

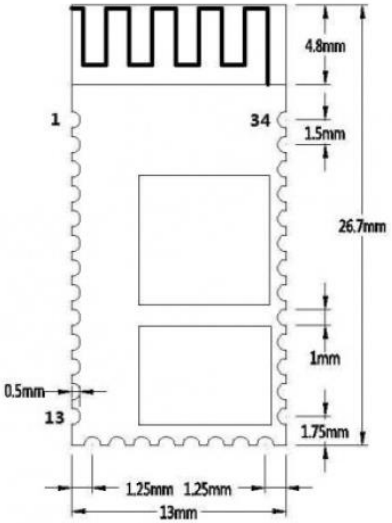


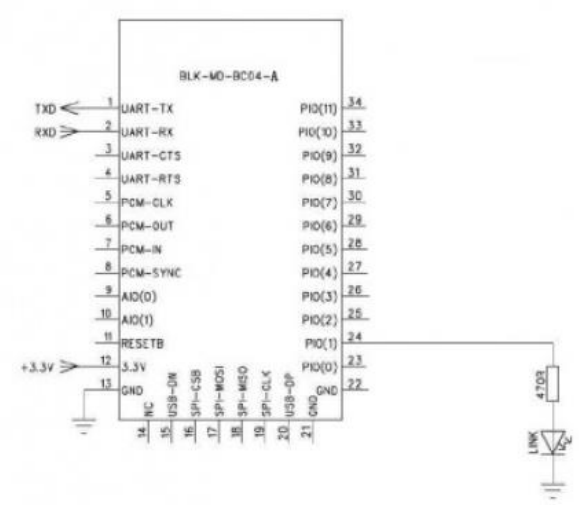
Spesification Arduino Mega

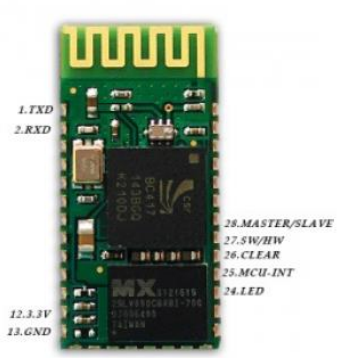
Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
Length	101.52 mm
Width	53.3 mm
Weight	37 g

2. Data Sheet Bluetooth HC-06

Schematic HC-06







Pin Number	Name	Type	Decription	Programmed for BC04-B
1	**UART-TX**	CMOS output	UART data output	Same
2	**UART-RX**	CMOS input	UART data input	Same
3	UART-CTS	CMOS input	UART cancel send	-
4	UART-RTS	CMOS output	UART request send	-
5	PCM-CLK	Double way	PCM clock	-
6	PCM-OUT	CMOS output	PCM data output	-

Mechanical Features

- Operating Frequency Band 2.4GHz -2.48GHz unlicensed ISM band
- Bluetooth Specification V2.1+EDR
- Output Power Class Class 2
- Operating Voltage 3.3V
- Host Interface USB 1.1/2.0 or UART
- Audio Interface PCM interface
- Flash Memory Size 8Mbit
- Dimension 27mm (L) x 13 (W) mm x 2mm (H)

3. Data Sheet Servo Paralax

PARALLAX

Web Site: www.parallax.com
Forums: forums.parallax.com
Sales: sales@parallax.com
Technical: support@parallax.com

Office: (916) 624-8333
Fax: (916) 624-8003
Sales: (888) 512-1024
Tech Support: (888) 997-8267

Parallax Continuous Rotation Servo (#900-00008)

The Parallax Standard Servo is ideal for adding bidirectional continuous rotation to your robotics projects.

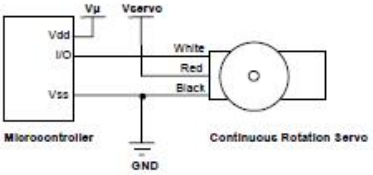
Features

- Bidirectional continuous rotation
- 0 to 50 RPM, with a linear response to PWM for easy ramping
- Accepts four mounting screws
- Easy to interface with any Parallax microcontroller or PWM-capable device
- Very easy to control with the PULSOUT command in PBASIC or SX/B
- Weighs only 1.50 oz (42.5 g)
- 38 oz-in torque @ 6 V

Key Specifications

- Power requirements: 4 to 6 VDC; Maximum current draw 140 +/- 50 mA at 6 VDC when operating in no load conditions, 15 mA when in static state
- Communication: pulse-width modulation
- Dimensions: approx 2.2 x 0.8 x 1.6 in (5.58x 1.9 x 4.06 cm) excluding servo horn
- Operating temperature range: 14 to 122 °F (-10 to +50 °C)

Quick-Start Circuit



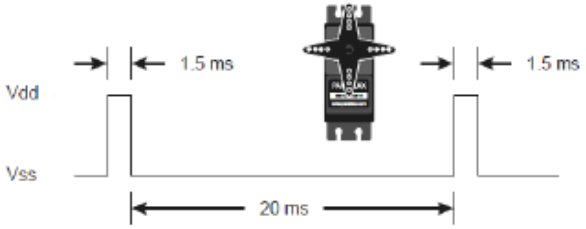
Vμ = microcontroller voltage supply

Vservo = 4 to 6 VDC, regulated or battery

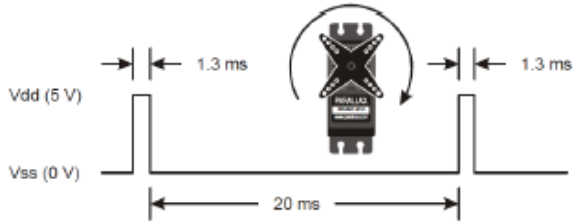
I/O = PWM TTL or CMOS output signal, 3.3 to 5 V; < Vservo + 0.2 V

Communication Protocol

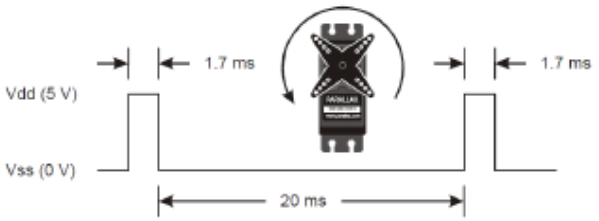
The Parallax Continuous Rotation Servo is controlled through pulse width modulation. Rotational speed and direction are determi ned by the d uration of a high pulse, i n the 1.3--1.7 ms range. In order for smooth rotation, the servo needs a 20 ms pause between pulses. Below is a sample timing diagram for a centered servo:



As the length of the pulse decreases from 1.5 ms, th e servo will gradually rotate faster in th e clockwise direction, as can be seen in the figure below:



Likewise, as the length of the pulse increases from 1.5 ms, the servo will gradually rotate faster in the counter-clockwise direction, as can be seen in the figure below:



4. Data Sheet Sensor Ultrasonik (PING)

PING)))™ Ultrasonic Distance Sensor (#28015)

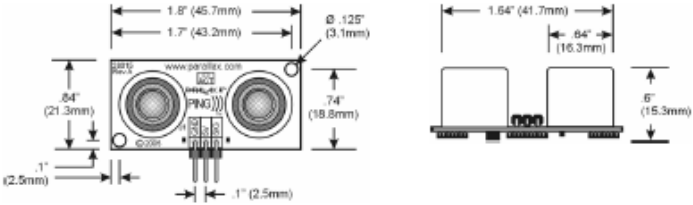
The Parallax PING))) ultrasonic distance sensor provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards). It is very easy to connect to BASIC Stamp® or Javelin Stamp microcontrollers, requiring only one I/O pin.

The PING))) sensor works by transmitting an ultrasonic (well above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width the distance to target can easily be calculated.

Features

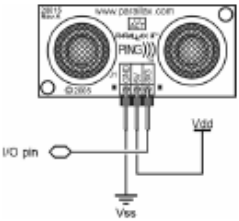
- Supply Voltage – 5 VDC
- Supply Current – 30 mA typ; 35 mA max
- Range – 2 cm to 3 m (0.8 in to 3.3 yrds)
- Input Trigger – positive TTL pulse, 2 uS min, 5 µs typ.
- Echo Pulse – positive TTL pulse, 115 uS to 18.5 ms
- Echo Hold-off – 750 µs from fall of Trigger pulse
- Burst Frequency – 40 kHz for 200 µs
- Burst Indicator LED shows sensor activity
- Delay before next measurement – 200 µs
- Size – 22 mm H x 46 mm W x 16 mm D (0.84 in x 1.8 in x 0.6 in)

Dimensions



Pin Definitions

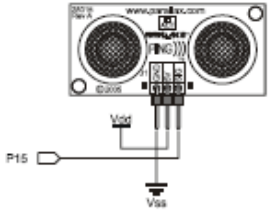
GND	Ground (Vss)
5 V	5 VDC (Vdd)
SIG	Signal (I/O pin)

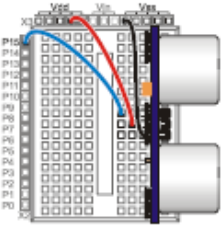


The PING))) sensor has a male 3-pin header used to supply power (5 VDC), ground, and signal. The header allows the sensor to be plugged into a solderless breadboard, or to be located remotely through the use of a standard servo extender cable (Parallax part #805-00002). Standard connections are show in the diagram to the right.

Quick-Start Circuit

This circuit allows you to quickly connect your PING))) sensor to a BASIC Stamp® 2 via the Board of Education® breadboard area. The PING))) module's GND pin connects to Vss, the 5 V pin connects to Vdd, and the SIG pin connects to I/O pin P15. This circuit will work with the example program Ping_Demo.BS2 listed on page 7.

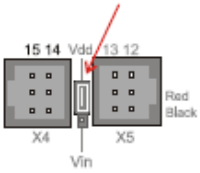




Servo Cable and Port Cautions

If you want to connect your PING))) sensor to a Board of Education using a servo extension cable, follow these steps:

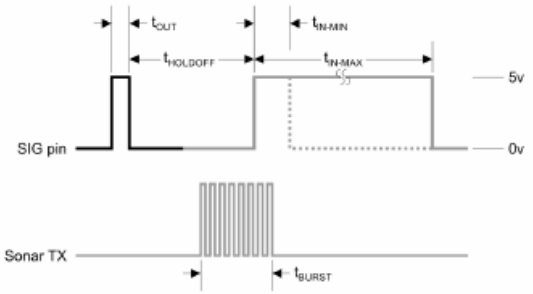
1. When plugging the cable onto the PING))) sensor, connect Black to GND, Red to 5 V, and White to SIG.
2. Check to see if your Board of Education servo ports have a jumper, as shown at right.
3. If your Board of Education servo ports have a jumper, set it to Vdd as shown.
4. If your Board of Education servo ports do not have a jumper, do not use them with the PING))) sensor. These ports only provide Vin, not Vdd, and this may damage your PING))) sensor. Go to the next step.
5. Connect the servo cable directly to the breadboard with a 3-pin header. Then, use jumper wires to connect Black to Vss, Red to Vdd, and White to I/O pin P15.



Board of Education Servo Port Jumper, Set to Vdd

Theory of Operation

The PING))) sensor detects objects by emitting a short ultrasonic burst and then "listening" for the echo. Under control of a host microcontroller (trigger pulse), the sensor emits a short 40 kHz (ultrasonic) burst. This burst travels through the air at about 1130 feet per second, hits an object and then bounces back to the sensor. The PING))) sensor provides an output pulse to the host that will terminate when the echo is detected, hence the width of this pulse corresponds to the distance to the target.



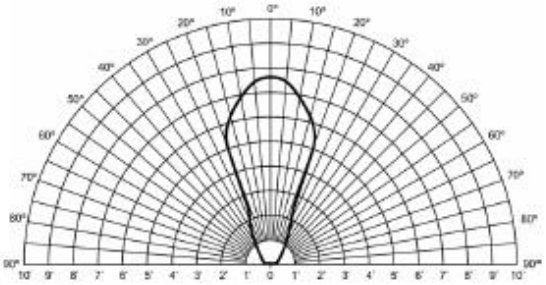
HOST	t_{OUT}	2 uS (min), 5 uS typical
PING	$t_{HOLDOFF}$	750 uS
	t_{BURST}	200 uS @ 40 kHz
	t_{IN-MIN}	115 uS
	t_{IN-MAX}	18.5 mS

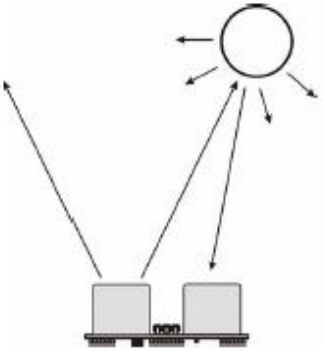
Test Data

The test data on the following pages is based on the PING))) sensor, tested in the Parallax lab, while connected to a BASIC Stamp microcontroller module. The test surface was a linoleum floor, so the sensor was elevated to minimize floor reflections in the data. All tests were conducted at room temperature, indoors, in a protected environment. The target was always centered at the same elevation as the PING))) sensor.

Test 1

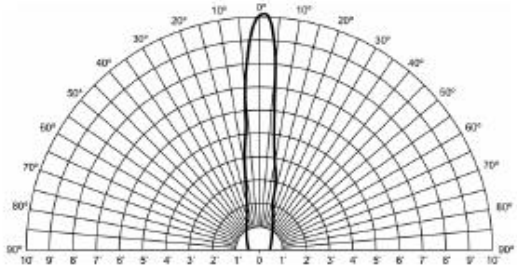
Sensor Elevation: 40 in. (101.6 cm)
Target: 3.5 in. (8.9 cm) diameter cylinder, 4 ft. (121.9 cm) tall – vertical orientation

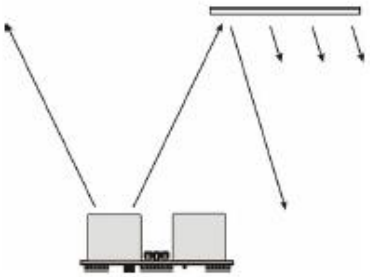




Test 2

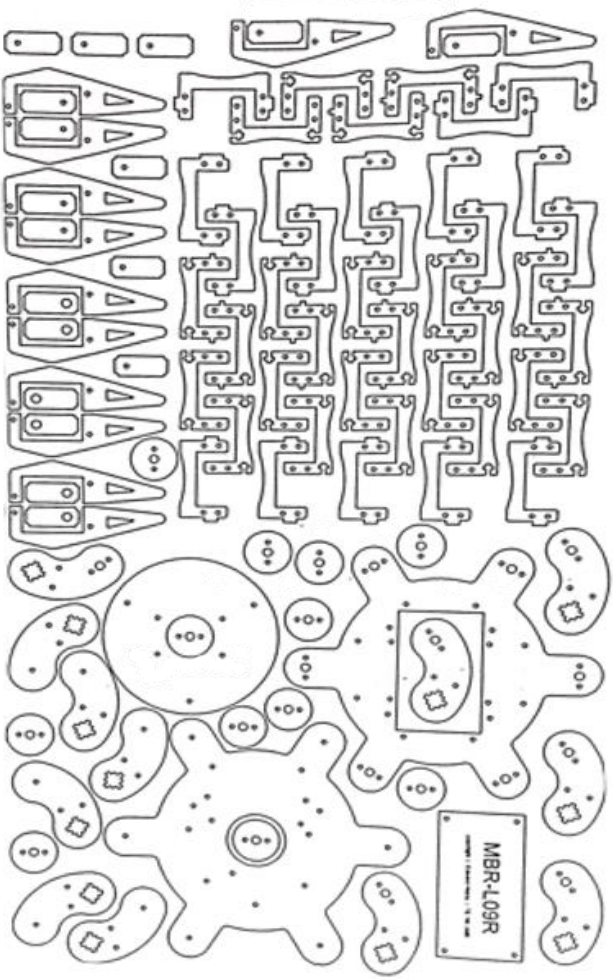
Sensor Elevation: 40 in. (101.6 cm)
Target: 12 in. x 12 in. (30.5 cm x 30.5 cm) cardboard, mounted on 1 in. (2.5 cm) pole
- target positioned parallel to backplane of sensor



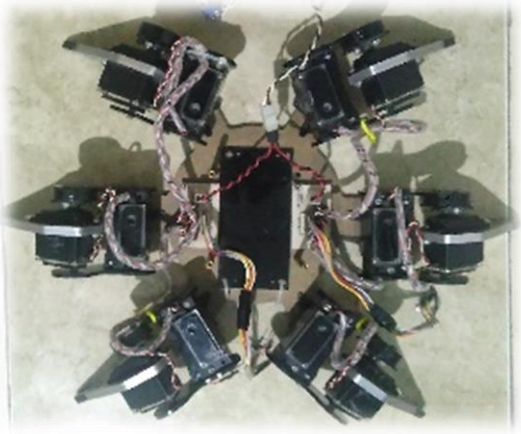


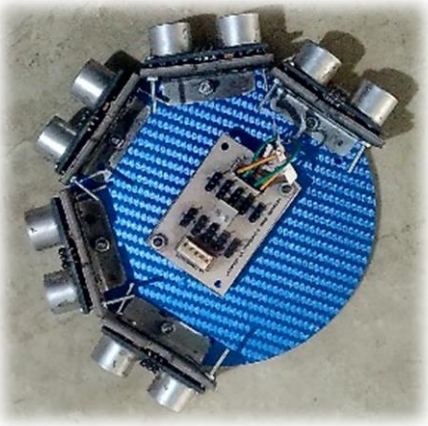
5. Mecanical Design

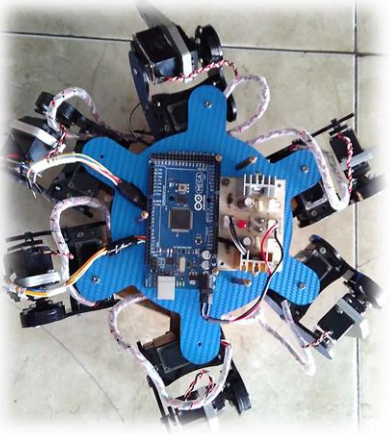
Body Desain

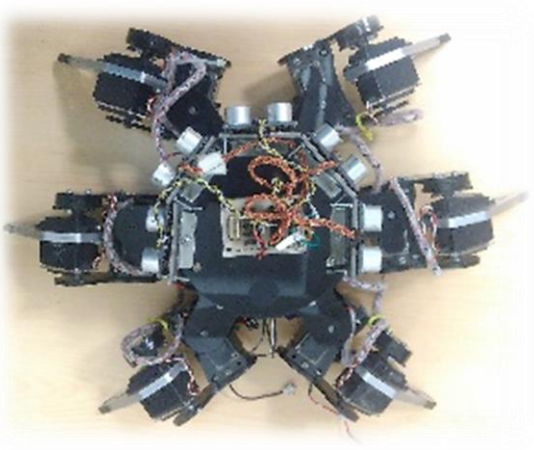


6. Proses Pembuatan Robot









7. Coding Robot

```
#define setbit(PORT,BITNUM)    ((PORT) |=  (1<<(BITNUM)))
#define clearbit(PORT,BITNUM)  ((PORT) &= ~(1<<(BITNUM)))
#define togglebit(PORT,BITNUM) ((PORT) ^=  (1<<(BITNUM)))

#define a_dpn_ka 14 // Kaki depan kanan
#define b_dpn_ka 15 // Bahu depan kanan
#define a_tgh_ka 16 // Kaki tengah kanan
#define b_tgh_ka 17 // Bahu tengah kanan
#define a_blk_ka 18 // Kaki belakang kanan
#define b_blk_ka 19 // Bahu belakang kanan

#define a_dpn_ki 12 // Kaki depan kiri
#define b_dpn_ki 11 // Bahu depan kiri
#define a_tgh_ki 10 // Kaki tengah kiri
#define b_tgh_ki 9  // Bahu tengah kiri
#define a_blk_ki 8  // Kaki belakang kiri
#define b_blk_ki 7  // Bahu belakang kiri

#define delay_pose_maju 40 // fast : 40 | normal : 80 | slow :
120
#define delay_pose_mundur 60
#define delay_pose_muter 40

//define pulse limit saya taruh di fungsi gerak

char pulse_counter,pose_counter,pose_limit,i;
char *pose;
char fase=1;//10 fase, 8-bit alokasi per servo
boolean start = true;
boolean A[6][8],B[6][8]; //array 2 dimensi, 6-servo @8-bit
//9 posisi sudut: 0, 22, 45, 67, 90, 112, 135, 157, 180.

int ultraSoundSignalPins[] = {30,32,34,36,38};
char *pingString[] = {"Depan : ","Depan Kiri : ", "Depan Kanan
: ", "Kiri : ", "Kanan : "};
```

```
//================================POSISI
SERVO=======================================


char berhenti1[] = {
                    22,22,22,    // kaki kanan : depan , tengah
, belakang
                    157,157,157, // kaki kiri  : depan , tengah
, belakang
                    90,90,90,    // bahu kanan : depan , tengah
, belakang
                    90,90,90     // bahu kiri  : depan , tengah
, belakang
                  };
char berhenti2[] = {
                    45,45,45,
                    135,135,135,
                    90,90,90,
                    90,90,90
                  };

char maju_step_1[]={22,22,22,157,157,157, 90,90, 90,90,90,90};
char maju_step_2[]={90,22,90,157, 90,157, 90,90, 90,90,90,90};
char maju_step_3[]={90,22,90,157, 90,157,135,90,135,90,45,90};
char maju_step_4[]={22,22,22,157,157,157,135,90,135,90,45,90};
char maju_step_5[]={22,22,22,157,157,157,90, 90,90,90,90,90};
char maju_step_6[]={22,90,22, 90,157, 90,90, 90,90,90,90,90};
char maju_step_7[]={22,90,22, 90,157, 90,90,135,90,45,90,45};
char maju_step_8[]={22,22,22,157,157,157,90,135,90,45,90,45};

char        mundur_step_1[]={22,22,22,157,157,157,90,90,90,90,
90,90};
char     mundur_step_2[]={90,22,90,157,     90,157,90,90,90,90,
90,90};
char                              mundur_step_3[]={90,22,90,157,
90,157,45,90,45,90,135,90};
```

```
char
mundur_step_4[]={22,22,22,157,157,157,45,90,45,90,135,90};
char   mundur_step_5[]={22,22,22,157,157,157,90,90,90,   90,90,
90};
char  mundur_step_6[]={22,90,22,  90,157,  90,90,90,90,  90,90,
90};
char             mundur_step_7[]={22,90,22,             90,157,
90,90,45,90,135,90,135};
char
mundur_step_8[]={22,22,22,157,157,157,90,45,90,135,90,135};

char        muter_kiri_1[]={22,22,22,157,157,157,        90,90,
90,90,90,90};
char muter_kiri_2[]={90,22,90,157, 90,157, 90,90, 90,90,90,90};
char                              muter_kiri_3[]={90,22,90,157,
90,157,135,90,135,90,135,90};
char
muter_kiri_4[]={22,22,22,157,157,157,135,90,135,90,135,90};
char        muter_kiri_5[]={22,22,22,157,157,157,        90,90,
90,90,90,90};
char muter_kiri_6[]={22,90,22, 90,157, 90,90,90,90, 90,90, 90};
char              muter_kiri_7[]={22,90,22,             90,157,
90,90,135,90,135,90,135};
char
muter_kiri_8[]={22,22,22,157,157,157,90,135,90,135,90,135};

char       muter_kanan_1[]={22,22,22,157,157,157,       90,90,
90,90,90,90};
char muter_kanan_2[]={22,90,22, 90,157, 90,90, 90,90,90,90,90};
char muter_kanan_3[]={22,90,22, 90,157, 90,90,45,90,45,90,45};
char muter_kanan_4[]={22,22,22,157,157,157,90,45,90,45,90,45};
char       muter_kanan_5[]={22,22,22,157,157,157,       90,90,
90,90,90,90};
char     muter_kanan_6[]={90,22,90,157,     90,157,90,90,90,90,
90,90};
char muter_kanan_7[]={90,22,90,157, 90,157,45,90,45,90,45,90};
char muter_kanan_8[]={22,22,22,157,157,157,45,90,45,90,45,90};
```

```
char muter1[]={22,22,22,157,157,157, 90,90, 90,90,90,90};
char muter2[]={22,90,22, 90,157, 90,90, 90,90,90,90,90};
char muter3[]={22,90,22, 90,157, 90,90,45,90,45,90,45};
char muter4[]={22,22,22,157,157,157,90,45,90,45,90,45};
char muter5[]={90,22,90,157, 90,157,90,45,90,45, 90,45};
char muter6[]={90,22,90,157, 90,157,45,45,45,45,45,45};
char muter7[]={22,22,22,157,157,157,45,45,45,45,45,45};



//================================SETUP=====================
=================


void setup() {
  noInterrupts();           // disable all interrupts
  TCCR1A = 0;TCCR1B = 0;
  TCNT1  = 0;OCR1A = 31250;
  TCCR1B |= (1<<WGM12) | (1<<CS11) | (1<<CS10); //CTC mode 64
prescaler
  TIMSK1 |= (1<<OCIE1A);   // enable timer 1A compare interrupt

pinMode(a_dpn_ka,OUTPUT);pinMode(a_tgh_ka,OUTPUT);pinMode(a_bl
k_ka,OUTPUT);
pinMode(a_dpn_ki,OUTPUT);pinMode(a_tgh_ki,OUTPUT);pinMode(a_bl
k_ki,OUTPUT);
pinMode(b_dpn_ka,OUTPUT);pinMode(b_tgh_ka,OUTPUT);pinMode(b_bl
k_ka,OUTPUT);
pinMode(b_dpn_ki,OUTPUT);pinMode(b_tgh_ki,OUTPUT);pinMode(b_bl
k_ki,OUTPUT);
  interrupts();             // enable all interrupts



  Serial.begin(9600);       // mengaktifkan serial monitor
  {gerak(berhenti2,sizeof(berhenti2)); delay(2000);}
  {gerak(berhenti1,sizeof(berhenti1)); delay(1000);}
}
```

```
//================================LOOP=======================
================

void loop(){
          sonar();
          delay(50);

          if(ultrasonic(0)<=20){ //Jarak Ping Depan
                    sonar();
                    delay(50);

                         if(ultrasonic(3)                    >
ultrasonic(4)){//muter kiri =>kanan lebih besar dari kiri
                                        muter_ki3();
                                        delay(20);
                                   Serial.println("a");
                              }

                              if(ultrasonic(3)                 <
ultrasonic(4)){//muter kanan
                                        muter_ka3();
                                        delay(20);
                                   Serial.println("b");
                              }
          }else if(ultrasonic(3) > 20 && ultrasonic(4) > 20){
                    maju2();muter_ka3();maju5();delay(20);
          }else if(ultrasonic(1) <=11){
                    muter_ka();delay(20);
                Serial.println("c");
          }else if(ultrasonic(2) <=11){
                    muter_ki();delay(20);
                Serial.println("d");
          }else{
                    maju();
                Serial.println("e");
          }
}
```

```
//================================FUNGSI                GERAKAN
ROBOT=======================================

void maju5(){
    for(int p=0;p<5;p++){
      maju();
    }
}

void maju2(){
    for(int p=0;p<2;p++){
      maju();
    }
}

void muter_ka3(){
    for(int p=0;p<3;p++){
      muter_ka();
    }
}

void muter_ki3(){
    for(int p=0;p<3;p++){
      muter_ki();
    }
}

void maju()
{
    #define pulse_limit 1 //1 pulse 20ms
    #define delay_tiap_pose delay_pose_maju
    #define delay_bahu (delay_tiap_pose*2)+20
    {
        gerak(maju_step_1,sizeof(maju_step_1));    //    posisi
normal
        delay(delay_tiap_pose);
        gerak(maju_step_2,sizeof(maju_step_2));    //    tripod
kanan angkat kaki
```

```
        delay(delay_tiap_pose);
        gerak(maju_step_3,sizeof(maju_step_3));    //    tripod
kanan maju bahu
        delay(delay_tiap_pose);
     }
    {
        gerak(maju_step_4,sizeof(maju_step_4));    //    tripod
kanan turun kaki tripod kanan kembali ke posisi normal
        delay(delay_tiap_pose);
    }
    delay(delay_bahu);                          // lamanya tripod
kanan kembali ke posisi normal
    {
        gerak(maju_step_5,sizeof(maju_step_5));
        delay(delay_tiap_pose);
        gerak(maju_step_6,sizeof(maju_step_6));
        delay(delay_tiap_pose);
        gerak(maju_step_7,sizeof(maju_step_7));
        delay(delay_tiap_pose);
    }
    {
        gerak(maju_step_8,sizeof(maju_step_8));
        delay(delay_tiap_pose);
    }
    delay(delay_bahu);
}

void mundur()
{
  #define pulse_limit 1 //1 pulse 20ms
  #define delay_tiap_pose delay_pose_mundur
  #define delay_bahu (delay_tiap_pose*2)+20
  {
  gerak(mundur_step_1,sizeof(mundur_step_1));
  delay(delay_tiap_pose);
  gerak(mundur_step_2,sizeof(mundur_step_2));
  delay(delay_tiap_pose);
  gerak(mundur_step_3,sizeof(mundur_step_3));
```

```
  delay(delay_tiap_pose);
  }
 {
  gerak(mundur_step_4,sizeof(mundur_step_4));
  delay(delay_tiap_pose);
 }
 delay(delay_bahu);
 {
  gerak(mundur_step_5,sizeof(mundur_step_5));
  delay(delay_tiap_pose);
  gerak(mundur_step_6,sizeof(mundur_step_6));
  delay(delay_tiap_pose);
  gerak(mundur_step_7,sizeof(mundur_step_7));
  delay(delay_tiap_pose);
 }
 {
  gerak(mundur_step_8,sizeof(mundur_step_8));
  delay(delay_tiap_pose);
 }
 delay(delay_bahu);
}

void muter_ki()
  {
    #define pulse_limit 1 //1 pulse 20ms
    #define delay_tiap_pose delay_pose_muter
    #define delay_bahu delay_tiap_pose*2
  {
  gerak(muter_kiri_1,sizeof(muter_kiri_1));
  delay(delay_tiap_pose);
  gerak(muter_kiri_2,sizeof(muter_kiri_2));
  delay(delay_tiap_pose);
  gerak(muter_kiri_3,sizeof(muter_kiri_3));
  delay(delay_tiap_pose);
  }
 {
  gerak(muter_kiri_4,sizeof(muter_kiri_4));
  delay(delay_tiap_pose);
```

```
 }
 delay(delay_bahu);
 {
  gerak(muter_kiri_5,sizeof(muter_kiri_5));
  delay(delay_tiap_pose);
  gerak(muter_kiri_6,sizeof(muter_kiri_6));
  delay(delay_tiap_pose);
  gerak(muter_kiri_7,sizeof(muter_kiri_7));
  delay(delay_tiap_pose);
  }
 {
  gerak(muter_kiri_8,sizeof(muter_kiri_8));
  delay(delay_tiap_pose);
 }
 delay(delay_bahu);
}

void muter_ka()
  {
    #define pulse_limit 1 //1 pulse = 1 x 20 ms = 20 ms
    #define delay_tiap_pose delay_pose_muter
    #define delay_bahu delay_tiap_pose*2
  {
  gerak(muter_kanan_1,sizeof(muter_kanan_1));
  delay(delay_tiap_pose);
  gerak(muter_kanan_2,sizeof(muter_kanan_2));
  delay(delay_tiap_pose);
  gerak(muter_kanan_3,sizeof(muter_kanan_3));
  delay(delay_tiap_pose);
  }
 {
  gerak(muter_kanan_4,sizeof(muter_kanan_4));
  delay(delay_tiap_pose);
 }
 delay(delay_bahu);
 {
  gerak(muter_kanan_5,sizeof(muter_kanan_5));
  delay(delay_tiap_pose);
```

```
  gerak(muter_kanan_6,sizeof(muter_kanan_6));
  delay(delay_tiap_pose);
  gerak(muter_kanan_7,sizeof(muter_kanan_7));
  delay(delay_tiap_pose);
  }
 {
  gerak(muter_kanan_8,sizeof(muter_kanan_8));
  delay(delay_tiap_pose);
 }
 delay(delay_bahu);
}

void muter()
  {
    #define pulse_limit 1 //1 pulse = 1 x 20 ms = 20 ms
    #define delay_tiap_pose delay_pose_muter
    #define delay_bahu delay_tiap_pose*2
  {
  gerak(muter1,sizeof(muter1));
  delay(delay_tiap_pose);
  gerak(muter2,sizeof(muter2));
  delay(delay_tiap_pose);
  gerak(muter3,sizeof(muter3));
  delay(delay_tiap_pose);
  gerak(muter4,sizeof(muter4));
  delay(delay_tiap_pose);
  gerak(muter5,sizeof(muter5));
  delay(delay_tiap_pose);
  gerak(muter6,sizeof(muter6));
  delay(delay_tiap_pose);
  }
 {
  gerak(muter7,sizeof(muter7));
  delay(delay_tiap_pose);
 }
 delay(delay_bahu);
}
```

```
//                          ==============================FUNGSI
SERVO==================================


void update_pose()
  {
    pulse_counter++;
    if((pulse_counter >= pulse_limit)||start)
     {
        start = false;
        pulse_counter = 0;
        i = pose_counter;
        setpose(pose[i]      ,pose[i+1]  ,pose[i+2]  ,pose[i+3]
,pose[i+4] ,pose[i+5],
                pose[i+6]   ,pose[i+7]   ,pose[i+8]   ,pose[i+9]
,pose[i+10],pose[i+11]);
        pose_counter = pose_counter+12;
    if(pose_counter >= pose_limit) pose_counter = 0;
     }
  }

void gerak(char pose_[],char pose_limit_)
  {
    pose = pose_;
    pose_limit    = pose_limit_;
    pose_counter  = 0;
    pulse_counter = 0;
  }

void  setpose(char  A_dpn_ka,char  A_tgh_ka,char  A_blk_ka,char
A_dpn_ki,char A_tgh_ki,char A_blk_ki,
             char  B_dpn_ka,char  B_tgh_ka,char  B_blk_ka,char
B_dpn_ki,char B_tgh_ki,char B_blk_ki)
  {
     switch (A_dpn_ka){
```

```
      case                                                          0
:A[0][0]=0;A[0][1]=0;A[0][2]=0;A[0][3]=0;A[0][4]=0;A[0][5]=0;A
[0][6]=0;A[0][7]=0;break;
      case                                                         22
:A[0][0]=1;A[0][1]=0;A[0][2]=0;A[0][3]=0;A[0][4]=0;A[0][5]=0;A
[0][6]=0;A[0][7]=0;break;
      case                                                         45
:A[0][0]=1;A[0][1]=1;A[0][2]=0;A[0][3]=0;A[0][4]=0;A[0][5]=0;A
[0][6]=0;A[0][7]=0;break;
      case                                                         67
:A[0][0]=1;A[0][1]=1;A[0][2]=1;A[0][3]=0;A[0][4]=0;A[0][5]=0;A
[0][6]=0;A[0][7]=0;break;
      case                                                         90
:A[0][0]=1;A[0][1]=1;A[0][2]=1;A[0][3]=1;A[0][4]=0;A[0][5]=0;A
[0][6]=0;A[0][7]=0;break;
      case
112:A[0][0]=1;A[0][1]=1;A[0][2]=1;A[0][3]=1;A[0][4]=1;A[0][5]=
0;A[0][6]=0;A[0][7]=0;break;
      case
135:A[0][0]=1;A[0][1]=1;A[0][2]=1;A[0][3]=1;A[0][4]=1;A[0][5]=
1;A[0][6]=0;A[0][7]=0;break;
      case
157:A[0][0]=1;A[0][1]=1;A[0][2]=1;A[0][3]=1;A[0][4]=1;A[0][5]=
1;A[0][6]=1;A[0][7]=0;break;
      case
180:A[0][0]=1;A[0][1]=1;A[0][2]=1;A[0][3]=1;A[0][4]=1;A[0][5]=
1;A[0][6]=1;A[0][7]=1;break;
     }
     switch (A_tgh_ka){
      case                                                          0
:A[1][0]=0;A[1][1]=0;A[1][2]=0;A[1][3]=0;A[1][4]=0;A[1][5]=0;A
[1][6]=0;A[1][7]=0;break;
      case                                                         22
:A[1][0]=1;A[1][1]=0;A[1][2]=0;A[1][3]=0;A[1][4]=0;A[1][5]=0;A
[1][6]=0;A[1][7]=0;break;
      case                                                         45
:A[1][0]=1;A[1][1]=1;A[1][2]=0;A[1][3]=0;A[1][4]=0;A[1][5]=0;A
[1][6]=0;A[1][7]=0;break;
```

```
      case                                                    67
:A[1][0]=1;A[1][1]=1;A[1][2]=1;A[1][3]=0;A[1][4]=0;A[1][5]=0;A
[1][6]=0;A[1][7]=0;break;
      case                                                    90
:A[1][0]=1;A[1][1]=1;A[1][2]=1;A[1][3]=1;A[1][4]=0;A[1][5]=0;A
[1][6]=0;A[1][7]=0;break;
      case
112:A[1][0]=1;A[1][1]=1;A[1][2]=1;A[1][3]=1;A[1][4]=1;A[1][5]=
0;A[1][6]=0;A[1][7]=0;break;
      case
135:A[1][0]=1;A[1][1]=1;A[1][2]=1;A[1][3]=1;A[1][4]=1;A[1][5]=
1;A[1][6]=0;A[1][7]=0;break;
      case
157:A[1][0]=1;A[1][1]=1;A[1][2]=1;A[1][3]=1;A[1][4]=1;A[1][5]=
1;A[1][6]=1;A[1][7]=0;break;
      case
180:A[1][0]=1;A[1][1]=1;A[1][2]=1;A[1][3]=1;A[1][4]=1;A[1][5]=
1;A[1][6]=1;A[1][7]=1;break;
      }
     switch (A_blk_ka){
      case                                                     0
:A[2][0]=0;A[2][1]=0;A[2][2]=0;A[2][3]=0;A[2][4]=0;A[2][5]=0;A
[2][6]=0;A[2][7]=0;break;
      case                                                    22
:A[2][0]=1;A[2][1]=0;A[2][2]=0;A[2][3]=0;A[2][4]=0;A[2][5]=0;A
[2][6]=0;A[2][7]=0;break;
      case                                                    45
:A[2][0]=1;A[2][1]=1;A[2][2]=0;A[2][3]=0;A[2][4]=0;A[2][5]=0;A
[2][6]=0;A[2][7]=0;break;
      case                                                    67
:A[2][0]=1;A[2][1]=1;A[2][2]=1;A[2][3]=0;A[2][4]=0;A[2][5]=0;A
[2][6]=0;A[2][7]=0;break;
      case                                                    90
:A[2][0]=1;A[2][1]=1;A[2][2]=1;A[2][3]=1;A[2][4]=0;A[2][5]=0;A
[2][6]=0;A[2][7]=0;break;
      case
112:A[2][0]=1;A[2][1]=1;A[2][2]=1;A[2][3]=1;A[2][4]=1;A[2][5]=
0;A[2][6]=0;A[2][7]=0;break;
```

```
      case
135:A[2][0]=1;A[2][1]=1;A[2][2]=1;A[2][3]=1;A[2][4]=1;A[2][5]=
1;A[2][6]=0;A[2][7]=0;break;
      case
157:A[2][0]=1;A[2][1]=1;A[2][2]=1;A[2][3]=1;A[2][4]=1;A[2][5]=
1;A[2][6]=1;A[2][7]=0;break;
      case
180:A[2][0]=1;A[2][1]=1;A[2][2]=1;A[2][3]=1;A[2][4]=1;A[2][5]=
1;A[2][6]=1;A[2][7]=1;break;
     }
     switch (A_dpn_ki){
      case                                                    0
:A[3][0]=0;A[3][1]=0;A[3][2]=0;A[3][3]=0;A[3][4]=0;A[3][5]=0;A
[3][6]=0;A[3][7]=0;break;
      case                                                   22
:A[3][0]=1;A[3][1]=0;A[3][2]=0;A[3][3]=0;A[3][4]=0;A[3][5]=0;A
[3][6]=0;A[3][7]=0;break;
      case                                                   45
:A[3][0]=1;A[3][1]=1;A[3][2]=0;A[3][3]=0;A[3][4]=0;A[3][5]=0;A
[3][6]=0;A[3][7]=0;break;
      case                                                   67
:A[3][0]=1;A[3][1]=1;A[3][2]=1;A[3][3]=0;A[3][4]=0;A[3][5]=0;A
[3][6]=0;A[3][7]=0;break;
      case                                                   90
:A[3][0]=1;A[3][1]=1;A[3][2]=1;A[3][3]=1;A[3][4]=0;A[3][5]=0;A
[3][6]=0;A[3][7]=0;break;
      case
112:A[3][0]=1;A[3][1]=1;A[3][2]=1;A[3][3]=1;A[3][4]=1;A[3][5]=
0;A[3][6]=0;A[3][7]=0;break;
      case
135:A[3][0]=1;A[3][1]=1;A[3][2]=1;A[3][3]=1;A[3][4]=1;A[3][5]=
1;A[3][6]=0;A[3][7]=0;break;
      case
157:A[3][0]=1;A[3][1]=1;A[3][2]=1;A[3][3]=1;A[3][4]=1;A[3][5]=
1;A[3][6]=1;A[3][7]=0;break;
      case
180:A[3][0]=1;A[3][1]=1;A[3][2]=1;A[3][3]=1;A[3][4]=1;A[3][5]=
1;A[3][6]=1;A[3][7]=1;break;
```

```
     }
     switch (A_tgh_ki){
      case                                                    0
:A[4][0]=0;A[4][1]=0;A[4][2]=0;A[4][3]=0;A[4][4]=0;A[4][5]=0;A
[4][6]=0;A[4][7]=0;break;
      case                                                   22
:A[4][0]=1;A[4][1]=0;A[4][2]=0;A[4][3]=0;A[4][4]=0;A[4][5]=0;A
[4][6]=0;A[4][7]=0;break;
      case                                                   45
:A[4][0]=1;A[4][1]=1;A[4][2]=0;A[4][3]=0;A[4][4]=0;A[4][5]=0;A
[4][6]=0;A[4][7]=0;break;
      case                                                   67
:A[4][0]=1;A[4][1]=1;A[4][2]=1;A[4][3]=0;A[4][4]=0;A[4][5]=0;A
[4][6]=0;A[4][7]=0;break;
      case                                                   90
:A[4][0]=1;A[4][1]=1;A[4][2]=1;A[4][3]=1;A[4][4]=0;A[4][5]=0;A
[4][6]=0;A[4][7]=0;break;
      case
112:A[4][0]=1;A[4][1]=1;A[4][2]=1;A[4][3]=1;A[4][4]=1;A[4][5]=
0;A[4][6]=0;A[4][7]=0;break;
      case
135:A[4][0]=1;A[4][1]=1;A[4][2]=1;A[4][3]=1;A[4][4]=1;A[4][5]=
1;A[4][6]=0;A[4][7]=0;break;
      case
157:A[4][0]=1;A[4][1]=1;A[4][2]=1;A[4][3]=1;A[4][4]=1;A[4][5]=
1;A[4][6]=1;A[4][7]=0;break;
      case
180:A[4][0]=1;A[4][1]=1;A[4][2]=1;A[4][3]=1;A[4][4]=1;A[4][5]=
1;A[4][6]=1;A[4][7]=1;break;
     }
     switch (A_blk_ki){
      case                                                    0
:A[5][0]=0;A[5][1]=0;A[5][2]=0;A[5][3]=0;A[5][4]=0;A[5][5]=0;A
[5][6]=0;A[5][7]=0;break;
      case                                                   22
:A[5][0]=1;A[5][1]=0;A[5][2]=0;A[5][3]=0;A[5][4]=0;A[5][5]=0;A
[5][6]=0;A[5][7]=0;break;
```

```
      case                                                    45
:A[5][0]=1;A[5][1]=1;A[5][2]=0;A[5][3]=0;A[5][4]=0;A[5][5]=0;A
[5][6]=0;A[5][7]=0;break;
      case                                                    67
:A[5][0]=1;A[5][1]=1;A[5][2]=1;A[5][3]=0;A[5][4]=0;A[5][5]=0;A
[5][6]=0;A[5][7]=0;break;
      case                                                    90
:A[5][0]=1;A[5][1]=1;A[5][2]=1;A[5][3]=1;A[5][4]=0;A[5][5]=0;A
[5][6]=0;A[5][7]=0;break;
      case
112:A[5][0]=1;A[5][1]=1;A[5][2]=1;A[5][3]=1;A[5][4]=1;A[5][5]=
0;A[5][6]=0;A[5][7]=0;break;
      case
135:A[5][0]=1;A[5][1]=1;A[5][2]=1;A[5][3]=1;A[5][4]=1;A[5][5]=
1;A[5][6]=0;A[5][7]=0;break;
      case
157:A[5][0]=1;A[5][1]=1;A[5][2]=1;A[5][3]=1;A[5][4]=1;A[5][5]=
1;A[5][6]=1;A[5][7]=0;break;
      case
180:A[5][0]=1;A[5][1]=1;A[5][2]=1;A[5][3]=1;A[5][4]=1;A[5][5]=
1;A[5][6]=1;A[5][7]=1;break;
     }
     switch (B_dpn_ka){
      case                                                     0
:B[0][0]=0;B[0][1]=0;B[0][2]=0;B[0][3]=0;B[0][4]=0;B[0][5]=0;B
[0][6]=0;B[0][7]=0;break;
      case                                                    22
:B[0][0]=1;B[0][1]=0;B[0][2]=0;B[0][3]=0;B[0][4]=0;B[0][5]=0;B
[0][6]=0;B[0][7]=0;break;
      case                                                    45
:B[0][0]=1;B[0][1]=1;B[0][2]=0;B[0][3]=0;B[0][4]=0;B[0][5]=0;B
[0][6]=0;B[0][7]=0;break;
      case                                                    67
:B[0][0]=1;B[0][1]=1;B[0][2]=1;B[0][3]=0;B[0][4]=0;B[0][5]=0;B
[0][6]=0;B[0][7]=0;break;
      case                                                    90
:B[0][0]=1;B[0][1]=1;B[0][2]=1;B[0][3]=1;B[0][4]=0;B[0][5]=0;B
[0][6]=0;B[0][7]=0;break;
```

```
      case
112:B[0][0]=1;B[0][1]=1;B[0][2]=1;B[0][3]=1;B[0][4]=1;B[0][5]=
0;B[0][6]=0;B[0][7]=0;break;
      case
135:B[0][0]=1;B[0][1]=1;B[0][2]=1;B[0][3]=1;B[0][4]=1;B[0][5]=
1;B[0][6]=0;B[0][7]=0;break;
      case
157:B[0][0]=1;B[0][1]=1;B[0][2]=1;B[0][3]=1;B[0][4]=1;B[0][5]=
1;B[0][6]=1;B[0][7]=0;break;
      case
180:B[0][0]=1;B[0][1]=1;B[0][2]=1;B[0][3]=1;B[0][4]=1;B[0][5]=
1;B[0][6]=1;B[0][7]=1;break;
     }
     switch (B_tgh_ka){
      case                                                    0
:B[1][0]=0;B[1][1]=0;B[1][2]=0;B[1][3]=0;B[1][4]=0;B[1][5]=0;B
[1][6]=0;B[1][7]=0;break;
      case                                                   22
:B[1][0]=1;B[1][1]=0;B[1][2]=0;B[1][3]=0;B[1][4]=0;B[1][5]=0;B
[1][6]=0;B[1][7]=0;break;
      case                                                   45
:B[1][0]=1;B[1][1]=1;B[1][2]=0;B[1][3]=0;B[1][4]=0;B[1][5]=0;B
[1][6]=0;B[1][7]=0;break;
      case                                                   67
:B[1][0]=1;B[1][1]=1;B[1][2]=1;B[1][3]=0;B[1][4]=0;B[1][5]=0;B
[1][6]=0;B[1][7]=0;break;
      case                                                   90
:B[1][0]=1;B[1][1]=1;B[1][2]=1;B[1][3]=1;B[1][4]=0;B[1][5]=0;B
[1][6]=0;B[1][7]=0;break;
      case
112:B[1][0]=1;B[1][1]=1;B[1][2]=1;B[1][3]=1;B[1][4]=1;B[1][5]=
0;B[1][6]=0;B[1][7]=0;break;
      case
135:B[1][0]=1;B[1][1]=1;B[1][2]=1;B[1][3]=1;B[1][4]=1;B[1][5]=
1;B[1][6]=0;B[1][7]=0;break;
      case
157:B[1][0]=1;B[1][1]=1;B[1][2]=1;B[1][3]=1;B[1][4]=1;B[1][5]=
1;B[1][6]=1;B[1][7]=0;break;
```

```
      case
180:B[1][0]=1;B[1][1]=1;B[1][2]=1;B[1][3]=1;B[1][4]=1;B[1][5]=
1;B[1][6]=1;B[1][7]=1;break;
     }
     switch (B_blk_ka){
      case                                                    0
:B[2][0]=0;B[2][1]=0;B[2][2]=0;B[2][3]=0;B[2][4]=0;B[2][5]=0;B
[2][6]=0;B[2][7]=0;break;
      case                                                   22
:B[2][0]=1;B[2][1]=0;B[2][2]=0;B[2][3]=0;B[2][4]=0;B[2][5]=0;B
[2][6]=0;B[2][7]=0;break;
      case                                                   45
:B[2][0]=1;B[2][1]=1;B[2][2]=0;B[2][3]=0;B[2][4]=0;B[2][5]=0;B
[2][6]=0;B[2][7]=0;break;
      case                                                   67
:B[2][0]=1;B[2][1]=1;B[2][2]=1;B[2][3]=0;B[2][4]=0;B[2][5]=0;B
[2][6]=0;B[2][7]=0;break;
      case                                                   90
:B[2][0]=1;B[2][1]=1;B[2][2]=1;B[2][3]=1;B[2][4]=0;B[2][5]=0;B
[2][6]=0;B[2][7]=0;break;
      case
112:B[2][0]=1;B[2][1]=1;B[2][2]=1;B[2][3]=1;B[2][4]=1;B[2][5]=
0;B[2][6]=0;B[2][7]=0;break;
      case
135:B[2][0]=1;B[2][1]=1;B[2][2]=1;B[2][3]=1;B[2][4]=1;B[2][5]=
1;B[2][6]=0;B[2][7]=0;break;
      case
157:B[2][0]=1;B[2][1]=1;B[2][2]=1;B[2][3]=1;B[2][4]=1;B[2][5]=
1;B[2][6]=1;B[2][7]=0;break;
      case
180:B[2][0]=1;B[2][1]=1;B[2][2]=1;B[2][3]=1;B[2][4]=1;B[2][5]=
1;B[2][6]=1;B[2][7]=1;break;
     }
     switch (B_dpn_ki){
      case                                                    0
:B[3][0]=0;B[3][1]=0;B[3][2]=0;B[3][3]=0;B[3][4]=0;B[3][5]=0;B
[3][6]=0;B[3][7]=0;break;
```

```
      case                                                    22
:B[3][0]=1;B[3][1]=0;B[3][2]=0;B[3][3]=0;B[3][4]=0;B[3][5]=0;B
[3][6]=0;B[3][7]=0;break;
      case                                                    45
:B[3][0]=1;B[3][1]=1;B[3][2]=0;B[3][3]=0;B[3][4]=0;B[3][5]=0;B
[3][6]=0;B[3][7]=0;break;
      case                                                    67
:B[3][0]=1;B[3][1]=1;B[3][2]=1;B[3][3]=0;B[3][4]=0;B[3][5]=0;B
[3][6]=0;B[3][7]=0;break;
      case                                                    90
:B[3][0]=1;B[3][1]=1;B[3][2]=1;B[3][3]=1;B[3][4]=0;B[3][5]=0;B
[3][6]=0;B[3][7]=0;break;
      case
112:B[3][0]=1;B[3][1]=1;B[3][2]=1;B[3][3]=1;B[3][4]=1;B[3][5]=
0;B[3][6]=0;B[3][7]=0;break;
      case
135:B[3][0]=1;B[3][1]=1;B[3][2]=1;B[3][3]=1;B[3][4]=1;B[3][5]=
1;B[3][6]=0;B[3][7]=0;break;
      case
157:B[3][0]=1;B[3][1]=1;B[3][2]=1;B[3][3]=1;B[3][4]=1;B[3][5]=
1;B[3][6]=1;B[3][7]=0;break;
      case
180:B[3][0]=1;B[3][1]=1;B[3][2]=1;B[3][3]=1;B[3][4]=1;B[3][5]=
1;B[3][6]=1;B[3][7]=1;break;
     }
     switch (B_tgh_ki){
      case                                                     0
:B[4][0]=0;B[4][1]=0;B[4][2]=0;B[4][3]=0;B[4][4]=0;B[4][5]=0;B
[4][6]=0;B[4][7]=0;break;
      case                                                    22
:B[4][0]=1;B[4][1]=0;B[4][2]=0;B[4][3]=0;B[4][4]=0;B[4][5]=0;B
[4][6]=0;B[4][7]=0;break;
      case                                                    45
:B[4][0]=1;B[4][1]=1;B[4][2]=0;B[4][3]=0;B[4][4]=0;B[4][5]=0;B
[4][6]=0;B[4][7]=0;break;
      case                                                    67
:B[4][0]=1;B[4][1]=1;B[4][2]=1;B[4][3]=0;B[4][4]=0;B[4][5]=0;B
[4][6]=0;B[4][7]=0;break;
```

```
      case                                                    90
:B[4][0]=1;B[4][1]=1;B[4][2]=1;B[4][3]=1;B[4][4]=0;B[4][5]=0;B
[4][6]=0;B[4][7]=0;break;
      case
112:B[4][0]=1;B[4][1]=1;B[4][2]=1;B[4][3]=1;B[4][4]=1;B[4][5]=
0;B[4][6]=0;B[4][7]=0;break;
      case
135:B[4][0]=1;B[4][1]=1;B[4][2]=1;B[4][3]=1;B[4][4]=1;B[4][5]=
1;B[4][6]=0;B[4][7]=0;break;
      case
157:B[4][0]=1;B[4][1]=1;B[4][2]=1;B[4][3]=1;B[4][4]=1;B[4][5]=
1;B[4][6]=1;B[4][7]=0;break;
      case
180:B[4][0]=1;B[4][1]=1;B[4][2]=1;B[4][3]=1;B[4][4]=1;B[4][5]=
1;B[4][6]=1;B[4][7]=1;break;
     }
     switch (B_blk_ki){
      case                                                     0
:B[5][0]=0;B[5][1]=0;B[5][2]=0;B[5][3]=0;B[5][4]=0;B[5][5]=0;B
[5][6]=0;B[5][7]=0;break;
      case                                                    22
:B[5][0]=1;B[5][1]=0;B[5][2]=0;B[5][3]=0;B[5][4]=0;B[5][5]=0;B
[5][6]=0;B[5][7]=0;break;
      case                                                    45
:B[5][0]=1;B[5][1]=1;B[5][2]=0;B[5][3]=0;B[5][4]=0;B[5][5]=0;B
[5][6]=0;B[5][7]=0;break;
      case                                                    67
:B[5][0]=1;B[5][1]=1;B[5][2]=1;B[5][3]=0;B[5][4]=0;B[5][5]=0;B
[5][6]=0;B[5][7]=0;break;
      case                                                    90
:B[5][0]=1;B[5][1]=1;B[5][2]=1;B[5][3]=1;B[5][4]=0;B[5][5]=0;B
[5][6]=0;B[5][7]=0;break;
      case
112:B[5][0]=1;B[5][1]=1;B[5][2]=1;B[5][3]=1;B[5][4]=1;B[5][5]=
0;B[5][6]=0;B[5][7]=0;break;
      case
135:B[5][0]=1;B[5][1]=1;B[5][2]=1;B[5][3]=1;B[5][4]=1;B[5][5]=
1;B[5][6]=0;B[5][7]=0;break;
```

```
      case
157:B[5][0]=1;B[5][1]=1;B[5][2]=1;B[5][3]=1;B[5][4]=1;B[5][5]=
1;B[5][6]=1;B[5][7]=0;break;
      case
180:B[5][0]=1;B[5][1]=1;B[5][2]=1;B[5][3]=1;B[5][4]=1;B[5][5]=
1;B[5][6]=1;B[5][7]=1;break;
     }
   }

ISR(TIMER1_COMPA_vect)             // timer compare interrupt
service routine
{// duty cycle 5% sampai 10%, T=20ms.
 // 9 sudut:    0  , 22, 45, 67, 90,112,135,157,180.
 //fase OCR1A = 250, 31, 31, 31, 32, 31, 31, 31, 32, 4500.
  switch (fase) {
    case 1: fase  = 2;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][0]);digitalWrite(a_tgh_ka,A[1][0]);
digitalWrite(a_blk_ka,A[2][0]);

digitalWrite(a_dpn_ki,A[3][0]);digitalWrite(a_tgh_ki,A[4][0]);
digitalWrite(a_blk_ki,A[5][0]);

digitalWrite(b_dpn_ka,B[0][0]);digitalWrite(b_tgh_ka,B[1][0]);
digitalWrite(b_blk_ka,B[2][0]);

digitalWrite(b_dpn_ki,B[3][0]);digitalWrite(b_tgh_ki,B[4][0]);
digitalWrite(b_blk_ki,B[5][0]);
            break;
    case 2: fase  = 3;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][1]);digitalWrite(a_tgh_ka,A[1][1]);
digitalWrite(a_blk_ka,A[2][1]);

digitalWrite(a_dpn_ki,A[3][1]);digitalWrite(a_tgh_ki,A[4][1]);
digitalWrite(a_blk_ki,A[5][1]);
```

```
digitalWrite(b_dpn_ka,B[0][1]);digitalWrite(b_tgh_ka,B[1][1]);
digitalWrite(b_blk_ka,B[2][1]);

digitalWrite(b_dpn_ki,B[3][1]);digitalWrite(b_tgh_ki,B[4][1]);
digitalWrite(b_blk_ki,B[5][1]);
            break;
    case 3: fase  = 4;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][2]);digitalWrite(a_tgh_ka,A[1][2]);
digitalWrite(a_blk_ka,A[2][2]);

digitalWrite(a_dpn_ki,A[3][2]);digitalWrite(a_tgh_ki,A[4][2]);
digitalWrite(a_blk_ki,A[5][2]);

digitalWrite(b_dpn_ka,B[0][2]);digitalWrite(b_tgh_ka,B[1][2]);
digitalWrite(b_blk_ka,B[2][2]);

digitalWrite(b_dpn_ki,B[3][2]);digitalWrite(b_tgh_ki,B[4][2]);
digitalWrite(b_blk_ki,B[5][2]);
            break;
    case 4: fase  = 5;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][3]);digitalWrite(a_tgh_ka,A[1][3]);
digitalWrite(a_blk_ka,A[2][3]);

digitalWrite(a_dpn_ki,A[3][3]);digitalWrite(a_tgh_ki,A[4][3]);
digitalWrite(a_blk_ki,A[5][3]);

digitalWrite(b_dpn_ka,B[0][3]);digitalWrite(b_tgh_ka,B[1][3]);
digitalWrite(b_blk_ka,B[2][3]);

digitalWrite(b_dpn_ki,B[3][3]);digitalWrite(b_tgh_ki,B[4][3]);
digitalWrite(b_blk_ki,B[5][3]);
            break;
    case 5: fase  = 6;
```

```
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][4]);digitalWrite(a_tgh_ka,A[1][4]);
digitalWrite(a_blk_ka,A[2][4]);

digitalWrite(a_dpn_ki,A[3][4]);digitalWrite(a_tgh_ki,A[4][4]);
digitalWrite(a_blk_ki,A[5][4]);

digitalWrite(b_dpn_ka,B[0][4]);digitalWrite(b_tgh_ka,B[1][4]);
digitalWrite(b_blk_ka,B[2][4]);

digitalWrite(b_dpn_ki,B[3][4]);digitalWrite(b_tgh_ki,B[4][4]);
digitalWrite(b_blk_ki,B[5][4]);
            break;
    case 6: fase  = 7;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][5]);digitalWrite(a_tgh_ka,A[1][5]);
digitalWrite(a_blk_ka,A[2][5]);

digitalWrite(a_dpn_ki,A[3][5]);digitalWrite(a_tgh_ki,A[4][5]);
digitalWrite(a_blk_ki,A[5][5]);

digitalWrite(b_dpn_ka,B[0][5]);digitalWrite(b_tgh_ka,B[1][5]);
digitalWrite(b_blk_ka,B[2][5]);

digitalWrite(b_dpn_ki,B[3][5]);digitalWrite(b_tgh_ki,B[4][5]);
digitalWrite(b_blk_ki,B[5][5]);
            break;
    case 7: fase  = 8;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][6]);digitalWrite(a_tgh_ka,A[1][6]);
digitalWrite(a_blk_ka,A[2][6]);

digitalWrite(a_dpn_ki,A[3][6]);digitalWrite(a_tgh_ki,A[4][6]);
digitalWrite(a_blk_ki,A[5][6]);
```

```
digitalWrite(b_dpn_ka,B[0][6]);digitalWrite(b_tgh_ka,B[1][6]);
digitalWrite(b_blk_ka,B[2][6]);

digitalWrite(b_dpn_ki,B[3][6]);digitalWrite(b_tgh_ki,B[4][6]);
digitalWrite(b_blk_ki,B[5][6]);
            break;
    case 8: fase  = 9;
            OCR1A = 47;

digitalWrite(a_dpn_ka,A[0][7]);digitalWrite(a_tgh_ka,A[1][7]);
digitalWrite(a_blk_ka,A[2][7]);

digitalWrite(a_dpn_ki,A[3][7]);digitalWrite(a_tgh_ki,A[4][7]);
digitalWrite(a_blk_ki,A[5][7]);

digitalWrite(b_dpn_ka,B[0][7]);digitalWrite(b_tgh_ka,B[1][7]);
digitalWrite(b_blk_ka,B[2][7]);

digitalWrite(b_dpn_ki,B[3][7]);digitalWrite(b_tgh_ki,B[4][7]);
digitalWrite(b_blk_ki,B[5][7]);
            break;
    case 9: fase  = 10;
            OCR1A = 4438;

digitalWrite(a_dpn_ka,LOW);digitalWrite(a_tgh_ka,LOW);digitalW
rite(a_blk_ka,LOW);

digitalWrite(a_dpn_ki,LOW);digitalWrite(a_tgh_ki,LOW);digitalW
rite(a_blk_ki,LOW);

digitalWrite(b_dpn_ka,LOW);digitalWrite(b_tgh_ka,LOW);digitalW
rite(b_blk_ka,LOW);

digitalWrite(b_dpn_ki,LOW);digitalWrite(b_tgh_ki,LOW);digitalW
rite(b_blk_ki,LOW);
            update_pose();
            break;
```

```
    case 10: fase  = 1;
            OCR1A = 188;

digitalWrite(a_dpn_ka,HIGH);digitalWrite(a_tgh_ka,HIGH);digita
lWrite(a_blk_ka,HIGH);

digitalWrite(a_dpn_ki,HIGH);digitalWrite(a_tgh_ki,HIGH);digita
lWrite(a_blk_ki,HIGH);

digitalWrite(b_dpn_ka,HIGH);digitalWrite(b_tgh_ka,HIGH);digita
lWrite(b_blk_ka,HIGH);

digitalWrite(b_dpn_ki,HIGH);digitalWrite(b_tgh_ki,HIGH);digita
lWrite(b_blk_ki,HIGH);
            break;
    }
}



//===========FUNGSI ULTRASONIC==========
void sonar()
  {
    unsigned long ultrasoundValue;
    for(int i=0; i < 5; i++){
      ultrasoundValue = ultrasonic(i);
      delay(1);
    }
    delay(1);
  }

unsigned long ultrasonic(int i){
    unsigned long echo;

    pinMode(ultraSoundSignalPins[i],   OUTPUT);   //   Switch
signalpin to output
    digitalWrite(ultraSoundSignalPins[i],  LOW);  //  Send  low
pulse
    delayMicroseconds(2); // Wait for 2 microseconds
```

```
    digitalWrite(ultraSoundSignalPins[i], HIGH); // Send high
pulse
    delayMicroseconds(5); // Wait for 5 microseconds
    digitalWrite(ultraSoundSignalPins[i], LOW); // Holdoff
    pinMode(ultraSoundSignalPins[i],    INPUT);    //    Switch
signalpin to input
    digitalWrite(ultraSoundSignalPins[i],  HIGH);  //  Turn  on
pullup resistor
    echo = pulseIn(ultraSoundSignalPins[i], HIGH); //Listen for
echo
    return (echo / 58.138); //convert to CM
  }
```

8. Coding Andriod Applicatoin

ActivityMain.Java

```
package main;

import java.io.*;
import java.util.Set;
import java.util.UUID;
import android.app.Activity;
import android.bluetooth.*;
import android.content.Context;
import android.content.Intent;
import android.graphics.Color;
import android.media.MediaPlayer;
import android.os.Bundle;
import android.os.Handler;
import android.os.Vibrator;
import android.util.Log;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.widget.*;

import com.example.hexapod.*;

public class ActivityMain extends Activity{
          MediaPlayer player;
          TextView maintxt, dpn,lblcon, datatxt;
          EditText myTextBox;
          ImageView iv_ki, iv_ka,iv_ser_ki, iv_ser_ka,iv_dpn;
          Vibrator vib;
          int dot=300, dash=600, IS=0, a=0;
          long pat2[]={0, dot, dash, dot, dash};
          long pat3[]={0, dot, dash, dot, dash, dot, dash};

          BluetoothAdapter mBluetoothAdapter;  BluetoothSocket
mmSocket;
```

```
        BluetoothDevice mmDevice;   OutputStream
mmOutputStream;
        InputStream mmInputStream;  Thread workerThread;
        byte[] readBuffer;
        int readBufferPosition;
        int counter;
        volatile boolean stopWorker;
        final Context context=this;

        @Override
        protected void onCreate(Bundle savedInstanceState) {
                // TODO Auto-generated method stub
                super.onCreate(savedInstanceState);
                setContentView(R.layout.main);

                maintxt
        =(TextView)findViewById(R.id.maintxt);
                dpn
        =(TextView)findViewById(R.id.dpn);
                lblcon
        =(TextView)findViewById(R.id.lblcon);
                datatxt
        =(TextView)findViewById(R.id.datatxt);
                iv_ki
        =(ImageView)findViewById(R.id.iv_ki);
                iv_dpn
        =(ImageView)findViewById(R.id.iv_dpn);
                iv_ser_ka
        =(ImageView)findViewById(R.id.iv_ser_ka);
                iv_ser_ki
        =(ImageView)findViewById(R.id.iv_ser_ki);
                iv_ka
        =(ImageView)findViewById(R.id.iv_ka);
                vib
        =(Vibrator)getSystemService(Context.VIBRATOR_SERVICE
);

                adapterBT();
```

```
        }

        //*********************************Override  Destroy
Vibration ************************************//
        @Override
        protected void onDestroy() {
                if(vib !=null){
                        vib.cancel();
                }
                super.onDestroy();
        }
        //*********************************END      Override
Destroy Vibration ************************************//

        //*********************************Function       BT
Adapter**************************************//
        void adapterBT(){
                mBluetoothAdapter                          =
BluetoothAdapter.getDefaultAdapter();
                if(mBluetoothAdapter == null)
                {
                        maintxt.setText("No      bluetooth
adapter available");
                }
                if(!mBluetoothAdapter.isEnabled())
                {
                        Intent   enableBluetooth   =   new
Intent(BluetoothAdapter.ACTION_REQUEST_ENABLE);

        startActivityForResult(enableBluetooth, 0);
                }
        }
        //********************************* END Function BT
Adapter**************************************//

        //*********************************Function Find BT
************************************//
```

```
        void findBT(){
                Set                         <BluetoothDevice>
pairedDevices=mBluetoothAdapter.getBondedDevices();
                if(pairedDevices.size()>0){
                        for(BluetoothDevice    device    :
pairedDevices){

        if(device.getName().equals("HC-06"))//bisa    diganti
sama nama bluetooth sendiri
                                                {
                                                mmDevice      =
device;

        Log.v("ArduinoBT",   "findBT   found   device   named
"+mmDevice.getName());

        Log.v("ArduinoBT",   "device   address   is   "   +
mmDevice.getAddress());
                                                break;

                                                }
                        }
                }
                maintxt.setText("Bluetooth Ditemukan = (HC-
06)");
        }
        //*********************************   END   Function
Find BT ************************************//

        //********************************* Function OPEN BT
************************************//
        void openBT() throws IOException{
                 UUID uuid = UUID.fromString("00001101-0000-
1000-8000-00805f9b34fb");
                // menggunakan Standar SerialPortService ID
                 mmSocket                                   =
mmDevice.createRfcommSocketToServiceRecord(uuid);
                 mmSocket.connect();
```

```
                    mmOutputStream                                =
mmSocket.getOutputStream();
                    mmInputStream = mmSocket.getInputStream();
                    beginListenForData();

                    maintxt.setText("Bluetooth Connected");
//                  vib.vibrate(900);
          }
          //*********************************   END   Function
OPEN BT ************************************//

          //********************************* Function DATA BT
************************************//
          void beginListenForData(){
                    final Handler handler = new Handler();
                    final  byte  delimiter  =  10;  //This  is  the
ASCII code for a newline character

                    stopWorker = false;
                    readBufferPosition = 0;
                    readBuffer = new byte[1024];

                    workerThread = new Thread(new Runnable(){
                              public void run(){

while(!Thread.currentThread().isInterrupted() && !stopWorker){
                                                  try{

int bytesAvailable = mmInputStream.available();

if(bytesAvailable > 0){

               byte[ ] packetBytes = new byte[bytesAvailable];

               mmInputStream.read(packetBytes);

               for(int i=0;i<bytesAvailable;i++){
```

```
                    byte b = packetBytes[i];

                    if(b == delimiter){

                                        byte[] encodedBytes = new
byte[readBufferPosition];


System.arraycopy(readBuffer,      0,      encodedBytes,      0,
encodedBytes.length);

                                        final String data = new
String(encodedBytes, "US-ASCII");

                                        readBufferPosition = 0;


                                        handler.post(new
Runnable(){

                                             public void run(){


maintxt.setText(data);


         ////////////////////////////////////////////////////

                                                  try {


                   GetData();


         } catch (IOException e) {
```

```
                    e.printStackTrace();


          }


          ////////////////////////////////////////////////

                                        }

                                    });

                    }

                    else{

                              readBuffer[readBufferPosition++]
= b;

                    }

               }
                                                                  }
                                                  }catch
(IOException ex){

stopWorker = true;
                                                  }
                                             }
                                        }
          });

          workerThread.start();
          }
          //**********************************END Function Data
BT************************************//
```

```
        ////////////////////////////////////////////////////
////////////////////////////////
        void GetData() throws IOException{
                try {

        lblcon.setText(Integer.toString(mmInputStream.read()
));

        if(Integer.parseInt(lblcon.getText().toString())==97
){
                                        vib.vibrate(300);
                                        dpn.setText("Go...");
                                        datatxt.setText("97");
                                        playSound(1);

        iv_dpn.setImageResource(R.drawable.dpn_on);

        iv_ki.setImageResource(R.drawable.ki_off);

        iv_ka.setImageResource(R.drawable.ka_off);

        iv_ser_ki.setImageResource(R.drawable.ser_ki_off);

        iv_ser_ka.setImageResource(R.drawable.ser_ka_off);
                            }else
if(Integer.parseInt(lblcon.getText().toString())==98){
                                        vib.vibrate(pat2,-1);
                                        dpn.setText("Turn
Right");
                                        datatxt.setText("98");
                                        playSound(2);

        iv_dpn.setImageResource(R.drawable.dpn_off);

        iv_ki.setImageResource(R.drawable.ki_off);

        iv_ka.setImageResource(R.drawable.ka_on);
```

```
        iv_ser_ki.setImageResource(R.drawable.ser_ki_off);

        iv_ser_ka.setImageResource(R.drawable.ser_ka_off);
                            }else
if(Integer.parseInt(lblcon.getText().toString())==99){
                                    vib.vibrate(pat3,-1);
                                    dpn.setText("Turn Left");
                                    datatxt.setText("99");
                                    playSound(3);

        iv_dpn.setImageResource(R.drawable.dpn_off);

        iv_ki.setImageResource(R.drawable.ki_on);

        iv_ka.setImageResource(R.drawable.ka_off);

        iv_ser_ki.setImageResource(R.drawable.ser_ki_off);

        iv_ser_ka.setImageResource(R.drawable.ser_ka_off);
                            }else
if(Integer.parseInt(lblcon.getText().toString())==100){
                                    vib.vibrate(1000);
                                    dpn.setText("Oblique
Left");
                                    datatxt.setText("100");
                                    playSound(4);

        iv_dpn.setImageResource(R.drawable.dpn_off);

        iv_ki.setImageResource(R.drawable.ki_off);

        iv_ka.setImageResource(R.drawable.ka_off);

        iv_ser_ki.setImageResource(R.drawable.ser_ki_on);

        iv_ser_ka.setImageResource(R.drawable.ser_ka_off);
                            }
```

```
                            else{
                                    vib.vibrate(1000);
                                    dpn.setText("Oblique
Right");
                                    playSound(5);
                                    datatxt.setText("101");

          iv_dpn.setImageResource(R.drawable.dpn_off);

          iv_ki.setImageResource(R.drawable.ki_off);

          iv_ka.setImageResource(R.drawable.ka_off);

          iv_ser_ki.setImageResource(R.drawable.ser_ki_off);

          iv_ser_ka.setImageResource(R.drawable.ser_ka_on);
                            }
                  } catch (IOException e) {
                  }
                  //ASCII FROM ARDUINO
//                a=97
//                b=98
//                c=99
//                d=100
//                e=101
          }
          ////////////////////////////////////////////////////
////////////////////////////////

          //******************************** Function CloseBT
**************************************//
          void closeBT() throws IOException
          {
           stopWorker = true;
           mmOutputStream.close();
           mmInputStream.close();
           mmSocket.close();
           maintxt.setText("Bluetooth Terputus");
```

```
          maintxt.setTextColor(Color.RED);
         }
         //*********************************   END   Funciton
Close BT************************************//

         //********************************* Function Create
Menu ************************************//
         public boolean onCreateOptionsMenu(Menu menu){
                  MenuInflater inflater=getMenuInflater();
                  inflater.inflate(R.menu.menu, menu);
                  return true;
         }

         public boolean onOptionsItemSelected(MenuItem item){
                  switch(item.getItemId()){
                  case R.id.connect:
                           lblcon.setText("Connect");
                           try{
                                    findBT();openBT();
                           }catch(Exception e){
                                    e.printStackTrace();
                           }
                           return true;
                  case R.id.disconnect:
                           lblcon.setText("Disconnect");
                           try{
                                    closeBT();
                           }catch(Exception e){
                                    e.printStackTrace();
                           }
                           return true;

                           default:
                                    return
super.onOptionsItemSelected(item);
                  }
         }
```

```
        //**********************************END      Function
Create Menu************************************//

        //**********************************Override     Play
SOUND************************************//
        @Override
        protected void onPause() {
                try{
                        player.pause();
                        super.onPause();
                }catch(Exception e){

                }
        }

        private void playSound(int arg){
                try{
                   if (player.isPlaying()) {
                        player.stop();
                       player.release();
                    }
                }catch(Exception e){
//                    Toast.makeText(this, " Masuk Exception",
Toast.LENGTH_LONG).show();
            }
            if (arg == 1){player = MediaPlayer.create(this,
R.raw.satu);vib.vibrate(200);}
                else       if       (arg==2){player       =
MediaPlayer.create(this, R.raw.dua);vib.vibrate(400);}
                else       if       (arg==3){player       =
MediaPlayer.create(this, R.raw.tiga);vib.vibrate(600);}
                else       if       (arg==4){player       =
MediaPlayer.create(this, R.raw.empat);vib.vibrate(pat2, -1);}
                else       if       (arg==5){player       =
MediaPlayer.create(this, R.raw.lima);vib.vibrate(pat3, -1);}
//                else       if       (arg==6){player       =
MediaPlayer.create(this, R.raw.enam);vib.vibrate(200);}
```

```
//                  else        if        (arg==7){player        =
MediaPlayer.create(this, R.raw.tujuh);vib.vibrate(400);}
//                  else        if        (arg==8){player        =
MediaPlayer.create(this, R.raw.delapan);vib.vibrate(600);}
//                  else        if        (arg==9){player        =
MediaPlayer.create(this,  R.raw.sembilan);vib.vibrate(pat2,   -
1);}
//                  else        if       (arg==10){player       =
MediaPlayer.create(this,   R.raw.sepuluh);vib.vibrate(pat3,   -
1);}


             player.setLooping(false); // Set looping
                  player.start();
  }
  //*********************************END     Override     Play
SOUND*************************************//
}
```

Main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<AbsoluteLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="@drawable/bg" >

    <TextView
        android:id="@+id/maintxt"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="4dp"
        android:layout_y="4dp"
        android:text="Large Text"

android:textAppearance="?android:attr/textAppearanceLarge" />

    <TextView
        android:id="@+id/lblcon"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="570dp"
        android:layout_y="5dp"
        android:text="Small Text"

android:textAppearance="?android:attr/textAppearanceSmall" />
```

```
    <ImageView
        android:id="@+id/iv_ki"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="70dp"
        android:layout_y="155dp"
        android:src="@drawable/ki_off" />

    <ImageView
        android:id="@+id/iv_ka"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="489dp"
        android:layout_y="167dp"
        android:src="@drawable/ka_off" />

    <ImageView
        android:id="@+id/iv_dpn"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="275dp"
        android:layout_y="6dp"
        android:src="@drawable/dpn_off" />

    <ImageView
        android:id="@+id/iv_ser_ki"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="122dp"
        android:layout_y="50dp"
        android:src="@drawable/ser_ki_off" />

    <ImageView
        android:id="@+id/iv_ser_ka"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="436dp"
        android:layout_y="61dp"
        android:src="@drawable/ser_ka_off" />

    <ImageView
        android:id="@+id/imageView6"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="241dp"
        android:layout_y="145dp"
        android:src="@drawable/bg_value" />

    <TextView
        android:id="@+id/datatxt"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="249dp"
        android:layout_y="151dp"
        android:text="@string/nav"
```

```
android:textAppearance="?android:attr/textAppearanceLarge"
        android:textSize="22sp" />

    <TextView
        android:id="@+id/dpn"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="309dp"
        android:layout_y="179dp"
        android:text="@string/nav"

android:textAppearance="?android:attr/textAppearanceSmall"
        android:textSize="22sp" />

</AbsoluteLayout>
```

AndroidManifest.xml

```
<?xml version="1.0" encoding="utf-8"?>
<AbsoluteLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="@drawable/bg" >

    <TextView
        android:id="@+id/maintxt"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="4dp"
        android:layout_y="4dp"
        android:text="Large Text"

android:textAppearance="?android:attr/textAppearanceLarge" />

    <TextView
        android:id="@+id/lblcon"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="570dp"
        android:layout_y="5dp"
        android:text="Small Text"

android:textAppearance="?android:attr/textAppearanceSmall" />

    <ImageView
        android:id="@+id/iv_ki"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="70dp"
        android:layout_y="155dp"
        android:src="@drawable/ki_off" />

    <ImageView
```

```
        android:id="@+id/iv_ka"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="489dp"
        android:layout_y="167dp"
        android:src="@drawable/ka_off" />

    <ImageView
        android:id="@+id/iv_dpn"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="275dp"
        android:layout_y="6dp"
        android:src="@drawable/dpn_off" />

    <ImageView
        android:id="@+id/iv_ser_ki"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="122dp"
        android:layout_y="50dp"
        android:src="@drawable/ser_ki_off" />

    <ImageView
        android:id="@+id/iv_ser_ka"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="436dp"
        android:layout_y="61dp"
        android:src="@drawable/ser_ka_off" />

    <ImageView
        android:id="@+id/imageView6"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="241dp"
        android:layout_y="145dp"
        android:src="@drawable/bg_value" />

    <TextView
        android:id="@+id/datatxt"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="249dp"
        android:layout_y="151dp"
        android:text="@string/nav"

android:textAppearance="?android:attr/textAppearanceLarge"
        android:textSize="22sp" />

    <TextView
        android:id="@+id/dpn"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="309dp"
        android:layout_y="179dp"
```

```
        android:text="@string/nav"

android:textAppearance="?android:attr/textAppearanceSmall"
        android:textSize="22sp" />

</AbsoluteLayout>
```

9. Profile Penulis

Name	:	Zendi Iklima
Place and date of birth	:	Jakarta, 14 Juni 1993
Sex	:	Male
Nationality	:	Indonesian
Marital Status	:	Lajang
ID Number	:	3674031406930003
Email	:	Zendi014@gmail.com
Address	:	Perum Pondok Kacang Prima Blok H2 no 11 RT 004 RW 008 Tangerang Selatan
Phone Number/Mobile	:	085773200135

EDUCATION

Elementary School	:	SDN Pondok Kacang Timur V
Secondary School	:	SMPN 1 Pondok Aren
Senior High School	:	SMA Budi Mulia
University	:	Mercu Buana Jakarta
Degree Awarded	:	S1
Faculty	:	Teknik / Teknik Elektro
Title of Thesis	:	Perancangan dan Pembuatan Score Board dan Timer Menggunakan LED RGB Berbasis Arduino dengan Kendali Smart Phone Android
GPA	:	3.88
University	:	Esa Unggul Jakarta
Degree Awarded	:	S1
Faculty	:	Ilmu Komputer / Teknik Informatika
GPA	:	3.53

SKILLS

Languages : English **Score TOEFL/TOIEC : 480/565**

ORGANIZATION EXPERIENCE

No. of Years	Title	Name of Organization
2011-2013	Rohis Universitas Mercu Buana	Al Faruq
2012-2013	Seksi Pendidikan Himpunan Mahasiswa Elektro angkatan 2011	HME
2011	Ketua Remaja Masjid	Masjid As Sakinah Tangsel

WORK EXPERIENCE

No. of Years	Position	Employer
2014	Engineer	CV. Global Controller Engineering
2013-2015	Guru	SMP Budi Bhakti Tangerang Selatan
2014-2015	Guru	SMA Bhinneka Tunggal Ika Jakarta Barat

ACTIVITIES NATIONAL/INTERNATIONAL

No. of Years	Position	Employer
2013	Workshop Lab View National instrumental (Peserta)	Universitas Bina Nusantara
2013	MTQN (Musabaqah Tilawatil Qur'an Nasional) XIII tahun 2013 (Official)	Universitas Negeri Padang dan Universitas Andalas
2013	Seminar Nasional Pengkajian dan Penerapan Teknologi Industri ke-3 (SNPPTI-2012) Green industry : principle , technology and its applications (Peserta)	Universitas Mercu Buana
2013	Workshop alat-alat lab IPA di LPMP –jakarta	Alkautsar AFLAH Mandiri
2013	Workshop Pelatihan Penerapan Kurikulum 2013 Fisika SMA	SMAN 2 Jakbar
2014	Seminar dan Workshop GFE (Google For Education) senayan	Google

ACHIEVEMENT

No. of Years	Title	Honors
2014	Juara Desain Robot terbaik di UMJ (Universitas Muhammadiyah Jakarta) Lomba Line Follower se JABODETABEK dengan Tim Elektro 2011	Sertificate
2013	Mahasiswa berprestasi teknik elektro 2013 dengan IPK : 3.81	Sertificate
2014	16 Besar Lomba Nasional kemanan jaringan UGM (GEMASTIK) dengan tim Jurusan IT UMB	Sertificate
2013	Juara 1 PKM UMB dengan Muhammad Hafidz Ibnu Hadjar dengan judul "Kursi roda menggunakan control android berbasis Arduino UNO (AnRoda Chair)"	Sertificate
2015	Wisudawan Berprestasi Tingkat Fakultas Teknik dengan IPK : 3.88	Sertificate

HOBBIES

Sports : Footsal, Badminton
Various : Band, Making Program Desktop Application, Mobile Application or Web Application