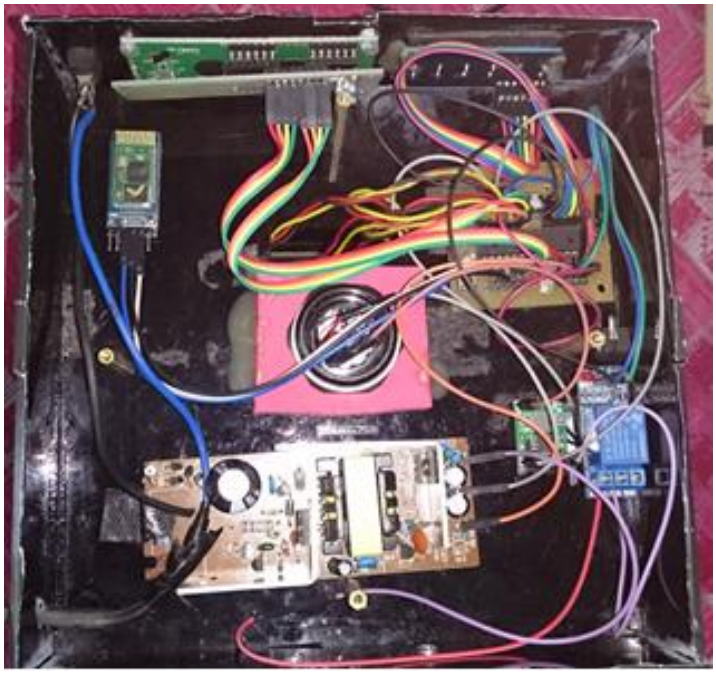
Gambar 1. Tampilan Alat Keseluruhan

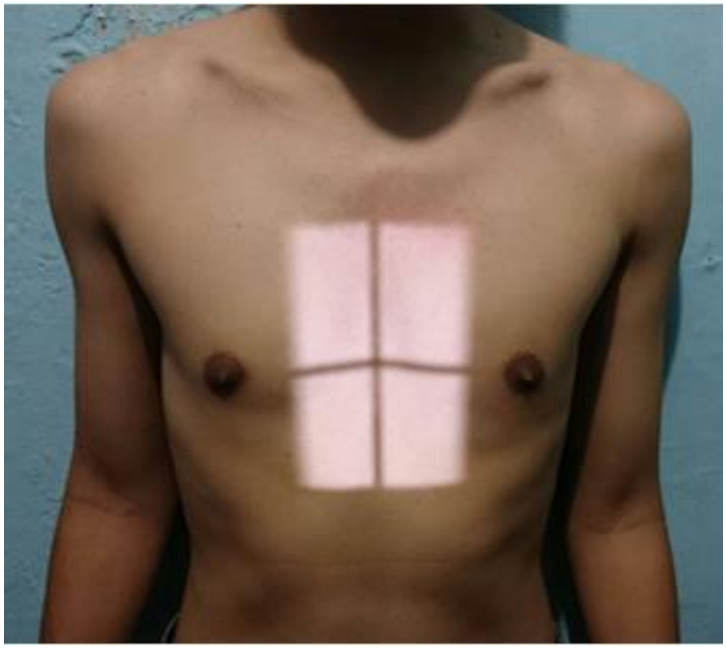
Gambar 2. Tampilan Depan Alat

Gambar 3. Tampilan Depan Alat Ketika Dinyalakan



Gambar 4. Blok Rangkaian

Gambar 5. Hasil Bidang Penyinaran



Gambar 6. Contoh Pengaplikasian Dalam Pengambilan Foto Toraks

```
// lcd library
#include <LiquidCrystal.h>
// servo library
#include <Servo.h>
// lcd konfigurasi
LiquidCrystal lcd(A0, A1, 2, 3, 4, 5);
// timer 2 library
#include <FlexiTimer2.h>
// eeprom libary
#include <EEPROM.h>

// mengaliaskan nama dan suatu angka

#define led   6

#define s1  9
#define s2  10
#define s3  11
#define s4  12
#define s5  13

// object servo
Servo myservo[4];

// global variable
int center=1000;
int timer,detik,tanda,vertikal,horisontal,tset;

// fungsi setup
// hanya di jalankan 1x saat pertama kali mikro on
void setup() {
 // port serial terbuka
 Serial.begin(38400);
  // setting pin mikro
 pinMode(led,OUTPUT);
 digitalWrite(led,HIGH);
 pinMode(s1,INPUT_PULLUP);
 pinMode(s2,INPUT_PULLUP);
 pinMode(s3,INPUT_PULLUP);
 pinMode(s4,INPUT_PULLUP);
 pinMode(s5,INPUT_PULLUP);
 // setting mode lcd
 lcd.begin(16, 2);
 // setting timer
 FlexiTimer2::set(1000,timer2isr);
 // start timer
 FlexiTimer2::start();
```

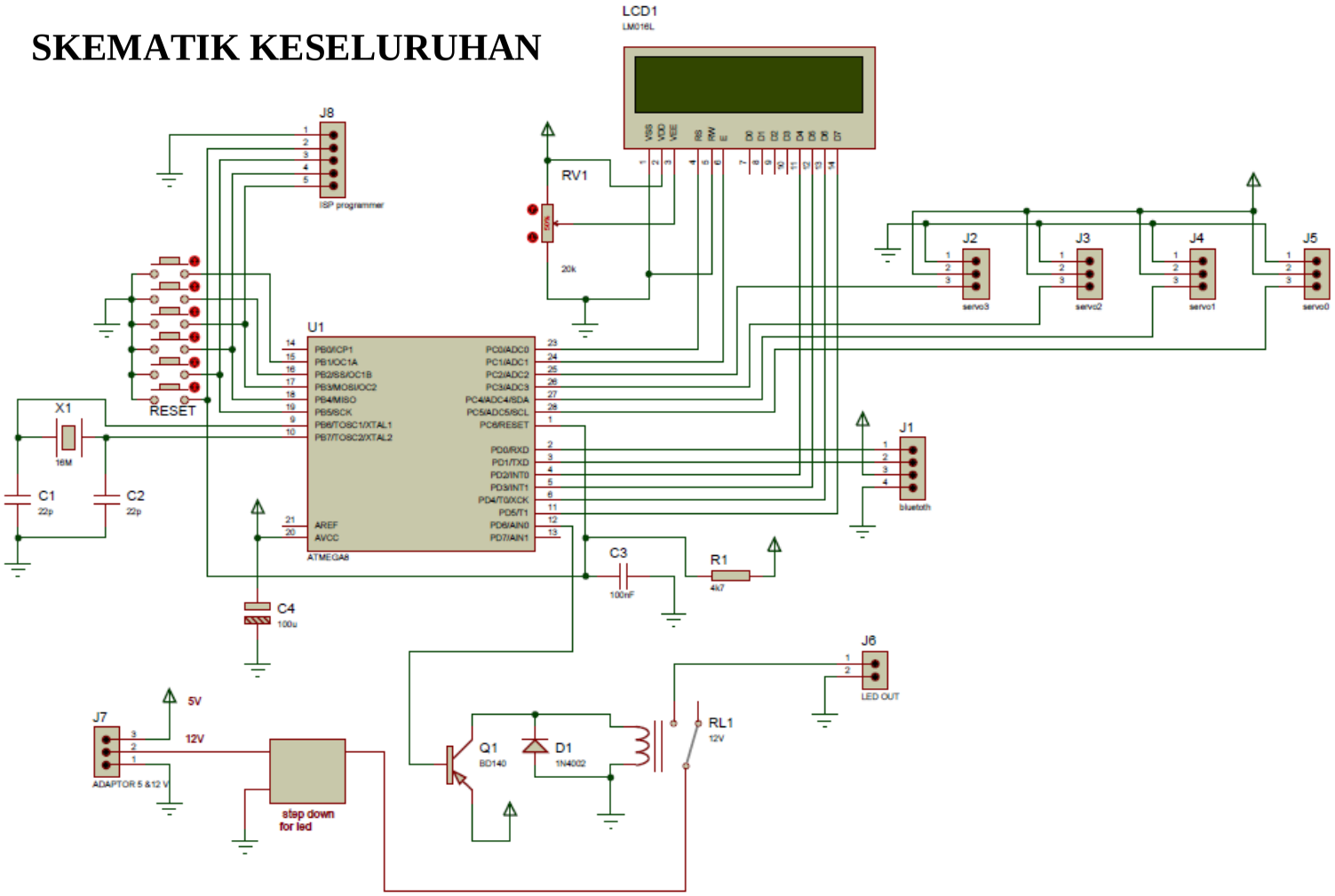
```
 // start tampilan
 lcd.clear();
 lcd.setCursor(0, 0);
 lcd.print("KOLIMATOR");
 lcd.setCursor(0, 1);
 lcd.print("ADI HARYONO");
 // jeda
 delay(1000);

 // aktifkan pin servo
 myservo[0].attach(A5);
 myservo[0].writeMicroseconds(center);

 myservo[1].attach(A4);
 myservo[1].writeMicroseconds(center);

 myservo[2].attach(A3);
 myservo[2].writeMicroseconds(center);

 myservo[3].attach(A2);
 myservo[3].writeMicroseconds(center);

 // salin data dari eeprom
 timer=EEPROM.read(0);
 //  salin data dari timer
 detik=timer;
 // salin data dari center
 vertikal=center;
 horisontal=center;
}

void loop() {
  char bluetoth=Serial.read();
  // tekan lama untuk masuk ke setting timer
  if(digitalRead(s5)==LOW||bluetoth=='5'){
  tset++;
  if(tset>5)settimer();
  }

  if(bluetoth=='6'){
  settimer();
  }

  // tekan cepat untuk menyalakan lampu
  if(digitalRead(s5)==HIGH||bluetoth=='5'){
  if(tanda==0&&tset>0){
```

```
  digitalWrite(led,LOW);  // lampu on
  detik=0;
  tanda=1;
  }
  tset=0;
  }

  // lampu off
  if(detik>=timer&&tanda==1){
  tanda=0;
  digitalWrite(led,HIGH);
  }

  // vertika;

if(digitalRead(s3)==LOW||bluetoth=='3')vertikal=verti
kal+10;

if(digitalRead(s4)==LOW||bluetoth=='4')vertikal=verti
kal-10;

  if(vertikal<1000)vertikal=1000;
  if(vertikal>1300)vertikal=1300;

  // horisontal

if(digitalRead(s1)==LOW||bluetoth=='1')horisontal=hor
isontal+10;

if(digitalRead(s2)==LOW||bluetoth=='2')horisontal=hor
isontal-10;

  if(horisontal<1000)horisontal=1000;
  if(horisontal>1320)horisontal=1320;

  // isi nilai ke servo

myservo[0].writeMicroseconds(map(vertikal,1000,2000,2
000,1000)); // vertikal atas

myservo[1].writeMicroseconds(map(vertikal,1000,2000,1
000,2000)); // vertikal bawah

myservo[2].writeMicroseconds(map(horisontal,1000,2000
,1000,2000)); // horisontal kiri
```

```
myservo[3].writeMicroseconds(map(horisontal,1000,2000
,2000,1000)); // horisontal kanan

  // tampilkan
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Timer: ");
  lcd.print(detik);
  lcd.setCursor(13, 0);
  lcd.print(bluetoth);
  lcd.setCursor(0, 1);
  lcd.print("V:");
  lcd.print(vertikal);
  lcd.setCursor(8, 1);
  lcd.print("H:");
  lcd.print(horisontal);
  delay(100); // jeda 100 ms
}
// fungsi isr
void timer2isr(){
  // tanda timer mencacah
if(tanda==1){
// timer mencacah jika nilai menit kurang dari batas
timer
if(detik<timer){
detik++;
}

}

}
// fungsi setting
void settimer(){
  lcd.clear();
  delay(500);

  while(1){
    char bluetoth=Serial.read();
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Timer:");
  lcd.print(timer);
  lcd.setCursor(13, 0);
  lcd.print(bluetoth);
  // naik turunkan angka
  if(digitalRead(s3)==LOW||bluetoth=='3')timer++;
```

```
  if(digitalRead(s4)==LOW||bluetoth=='4')timer--;
  if(digitalRead(s5)==LOW||bluetoth=='6')break;
  // batas
  if(timer>60)timer=1;
  if(timer<1)timer=60;
  delay(200);
  }
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("SAVE");
  delay(500);
  // simpan ke eeprom
  EEPROM.write(0,timer);
  detik=timer;
  tset=0;
}
```

SKEMATIK KESELURUHAN



DATA SHEET MODUL SERVO HS-645MG

Product Description

The powerful HS-645MG is one of Hitec's most popular servos. It's the perfect choice for those larger sport planes or monster trucks and buggies requiring a durable high torque servo. Featuring our unique M/P and metal gear train technology, the HS-645MG offers one of the strongest gear trains available in any servo.

Features

- Top Selling High Torque Metal Gear Servo
- Strong Three-Pole Ferrite Motor
- Heavy Duty Metal Gear Train Featuring our Revolutionary Metal/Plastic First Gear (MP Gear)
- Dual Ball Bearing-Supported Output Shaft

Accessories

- Metal Gear Set
- Metal / Plastic 1st Gear Set
- Plastic Case Set
- Applicable Horns

HS-645MG Servo Specifications

Performance Specifications	
Operating Voltage Range (Volts DC)	4.8V ~ 6.0V
Speed (Second @ 60°)	0.24 ~ 0.20
Maximum Torque Range oz. / in.	107 ~ 133
Maximum Torque Range kg. / cm.	7.7 ~ 9.6
Current Draw at Idle	9.1 mA
No Load Operating Current Draw	450 mA
Stall Current Draw	2,500 mA
Dead Band Width	8 µs
Physical Specifications	
Dimensions (Inches)	1.59 x 0.77 x 1.48
Dimensions (Metric)	40.6 x 19.8 x 37.8
Weight (Ounces)	1.94
Weight (Gram)	55.2
Circuit Type	HT7003 Analog SMT
Motor Type	3 Pole Metal Brush Ferrite
Gear Material	Metal
Bearing Type	Dual Ball Bearing
Output Shaft (type / Ømm)	Standard 24
Case Material	Plastic
Dust / Water Resistance	N / A
Connector Gauge (AWG) / Strand Count	22 / 60

PERATURAN KEPALA BADAN PENGAWAS TENAGA NUKLIR NOMOR 9 TAHUN 2011 TENTANG UJI KESESUAIAN PESAWAT SINAR-X RADIOLOGI DIAGNOSTIK DAN INTERVENSIONAL

Parameter	Hasil uji	Nilai Lolos Uji
A. Kolimasi Berkas Cahaya		
1. Iluminasi (Ilum)	Ilum = ... lux	Ilum ≥ 100 lux
2. Selisih lapangan kolimasi dengan lapangan berkas sinar-x (Δ)	Δ_X = ... mm (... % SID); Δ_Y = ... mm (... % SID)	Δ_X dan Δ_Y ≤ 2% SID; $\lvert\Delta_X\rvert + \lvert\Delta_Y\rvert \leq 3\%$ SID
B. Generator dan Tabung Sinar-X		
1. Akurasi tegangan	e_{maks} = ... %, pada ... kVp	e ≤ ± 10 %
2. Akurasi waktu penyinaran		
i. t = 100 ms	e_{maks} = ... ms (... %), pada ... ms	e ≤ ± 10 %
ii. t < 100 ms (gen. 2 pulsa)	e_{maks} = ... pulsa (... ms), pada ... ms	e ≤ ± 1pulsa (10 ms)
iii. t < 100 ms (gen. HF / lainnya)	e_{maks} = ... ms (...% + ...), pada ... ms	e ≤ ± (10 %+1) ms
3. Linearitas keluaran radiasi	CL = ...	CL ≤ 0,1
4. Reproduksibilitas		
i. keluaran radiasi (output)	CV = ...	CV ≤ 0,05
ii. tegangan puncak (kVp)	CV = ...	CV ≤ 0,05
iii. waktu penyinaran (ms)	CV = ...	CV ≤ 0,05
5. Kualitas berkas sinar-X (HVL)	HVL = ... mm Al (pada 80 kVp)	HVL ≥ 2,3 mmAl (80 kVp)
6. Kebocoran wadah tabung (L)	L = ... mGy dalam 1 jam	L ≤ 1 mGy dlm 1 jam
C. Kendali Paparan Otomatis (AEC)		
1. timer darurat (sinyal audio/visual)	berhenti darurat setelah ... mAs /... s	≤ 600 mAs / 6 s
2. densitas standar & uniformitas :		
i. variasi OD film, mAs konstan	Δ OD (maks. - min.) = ...	Δ OD ≤ ± 0,1 OD rerata
ii. variasi mAs, OD konstan	Δ mAs (maks. - min.) = ...	Δ mAs ≤ ± 0,2 mAs rerata
3. penjejakan:		
i. ketebalan pasien (kVp konstan)	Δ OD (maks. - min.) = ...	Δ OD ≤ ± 0,1 OD rerata
ii. kVp (tebal konstan)	Δ OD (maks. - min.) = ...	Δ OD ≤ ± 0,15 OD rerata
iii. kombinasi tebal dan kVp	Δ OD (maks. - min.) = ...	Δ OD ≤ ± 0,2 OD rerata
4. waktu respon minimum:		
i. 1 fase	$t_{respon\ min}$ = ... ms	$t_{respon\ min}$ = 20 ms
ii. 3 fase atau HF	$t_{respon\ min}$ = ... ms	$t_{respon\ min}$ = 1- 3 ms
D. Informasi Dosis Pasien		
Perkiraan ESD udara: *AP abdominal projection*		
i. mAs sesuai AEC (dgn fantom)	ESD udara = ... mGy	ESD udara ≤ ...mGy
ii. mAs klinis rutin (tanpa fantom)	ESD udara = ... mGy	