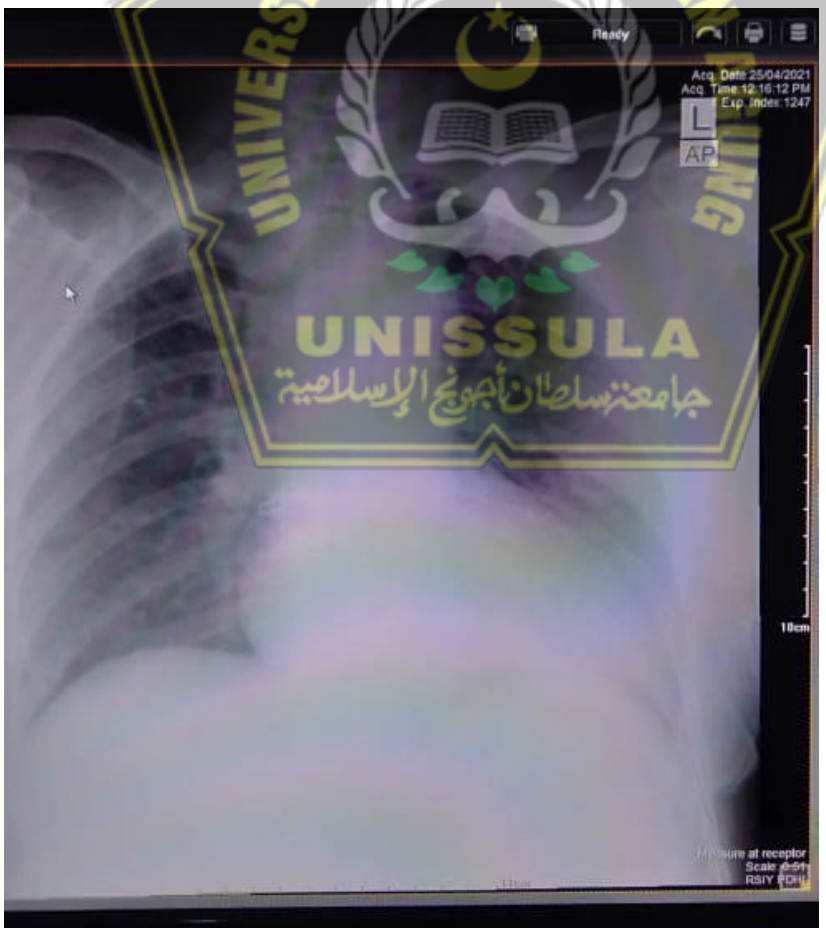
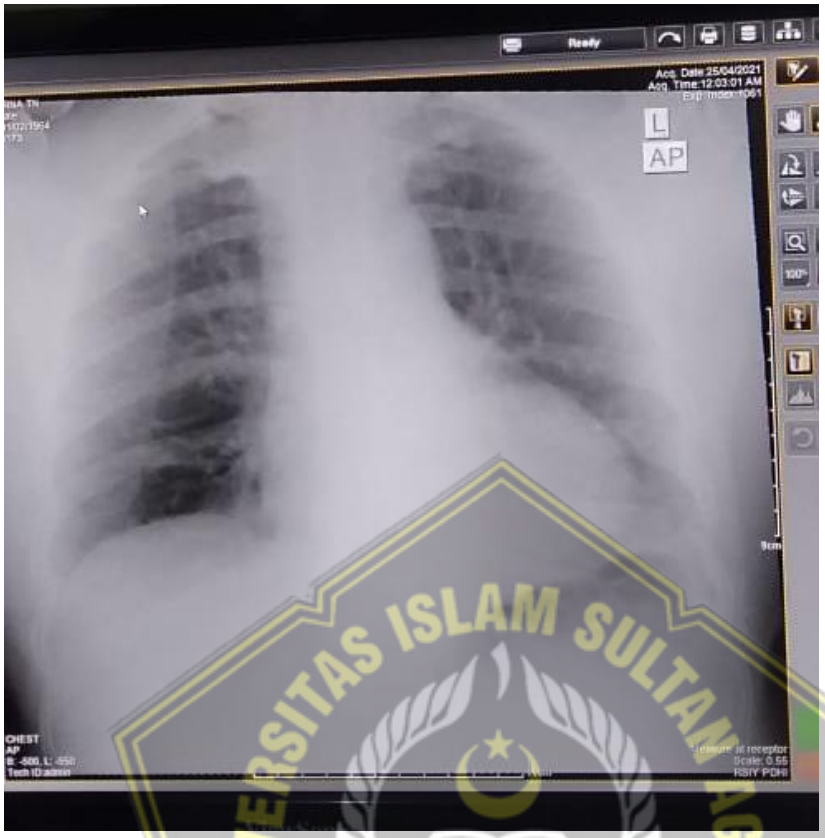
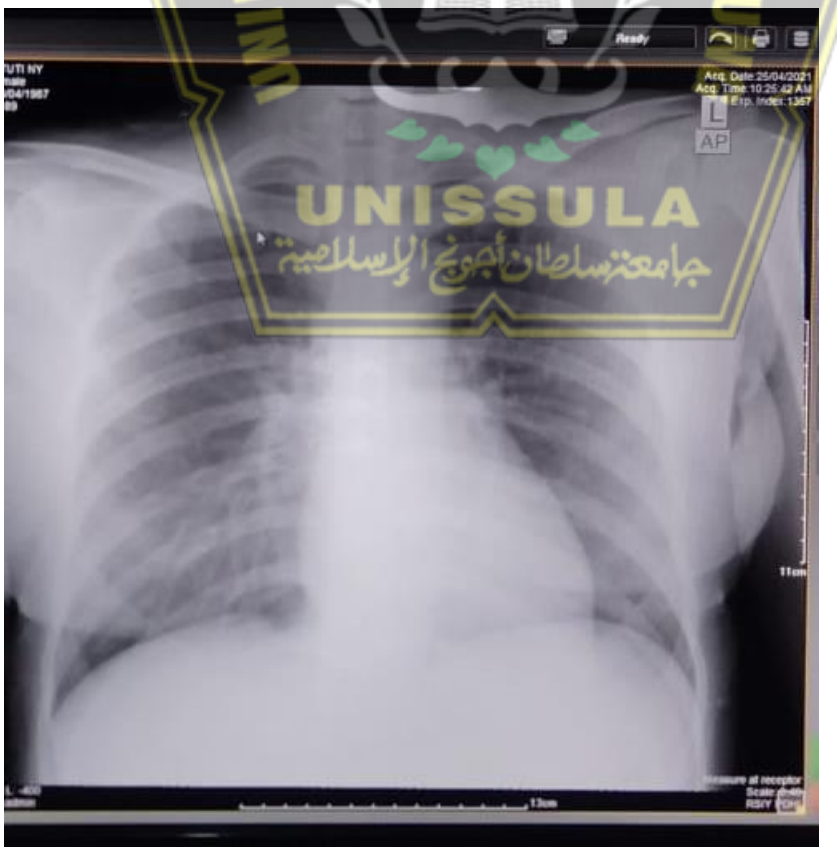
LAMPIRAN


Ready
L
AP
10cm


Ready
Acq. Date:25/04/2021
Acq. Time:12:16:12 PM
Exp. Index:1247
L
AP
10cm





Lampiran source code arduino nano switching single ekspose

```
#include <EEPROM.h>
#include <SimpleTimer.h>

SimpleTimer timer;
struct MyData {
  int v1;
  int v2;
  int v3;
  int v4;
  int v5;
  int v6;
  int v7;
};

String readstring;
MyData customVar;
int incomingByte = 0;

int timerROT;
int timerPRE;

int PIN_PRE = 4;
int PIN_ROT = 3;
int PIN_EXP = 5;

int pin_buzzer = 2;



void setup(){
Serial.begin(9600);
Serial.println("kontrol single ekspose start");
EEPROM.get(0,customVar);
Serial.println("read EEPROM internal memori");
pinMode(PIN_EXP,OUTPUT);
pinMode(PIN_ROT,OUTPUT);
pinMode(PIN_PRE,OUTPUT);

pinMode(pin_buzzer,OUTPUT);


}

void loop(){
  String command;

 while(Serial.available()) {
  Serial.println(".");
```

```
delay(20);
char c = Serial.read();
if (c==','){
 break;
}
readstring += c;
 }

if (readstring.length()>0){
 command = readstring.substring(0,3);

 if (command=="RDI"){
   Serial.println("read EEPROM internal memori");
    EEPROM.get(0,customVar);
   Serial.print("*#");
   Serial.println(customVar.v1);
   Serial.println("#");
   Serial.println(customVar.v2);
   Serial.println("#");
   Serial.println(customVar.v3);
   Serial.println("#");
   Serial.println(customVar.v4);
   Serial.println("#");
   Serial.println(customVar.v5);
   Serial.println("#");
   Serial.println(customVar.v6);
   Serial.println("#");
   Serial.println(customVar.v7);
   Serial.println("#~");

 }else if (command=="WRI"){
    customVar = {
  (readstring.substring(4)).toInt(),
  (readstring.substring(6,10)).toInt(),
  (readstring.substring(11)).toInt(),
  (readstring.substring(13,16)).toInt(),
  (readstring.substring(17,20)).toInt(),
  (readstring.substring(21,25)).toInt(),
  (readstring.substring(26,30)).toInt()
 };
  EEPROM.put(0, customVar);
 }else if (command=="EXP"){
   incomingByte= (readstring.substring(4,7)).toInt();
 nyala();
 if ((readstring.substring(13)).toInt()>1){
 delay((readstring.substring(8,12)).toInt()*0.75);
 padamulang();
 }else{
 delay((readstring.substring(8,12)).toInt());
 padam();
```

```
    }
    }else if (command=="PRE"){
     Serial.println("Preheat dan Rotarting start");
     digitalWrite(PIN_PRE,HIGH);
     digitalWrite(PIN_ROT,HIGH);
    timer.deleteTimer(timerROT);
    timer.deleteTimer(timerPRE);
    timerROT=timer.setTimeout(customVar.v2,rotlow);
    timerPRE=timer.setTimeout(6000,prelow);


    }else{
     digitalWrite(PIN_PRE,LOW);
     Serial.println("Preheat stop");
    }

    readstring="";
   }
   timer.run();

  }

  void nyala(){
    if(incomingByte==101){
     Serial.println("Ekspose start");
   digitalWrite(PIN_EXP,HIGH); //40
   digitalWrite(pin_buzzer,HIGH);
    }

  }
  void padam(){
  digitalWrite(PIN_EXP,LOW);
  Serial.println("Ekspose stop");
  digitalWrite(PIN_ROT,LOW);
  Serial.println("Rotarting stop");
  digitalWrite(PIN_PRE,LOW);
  Serial.println("Preheat stop");
  digitalWrite(pin_buzzer,LOW);

   timer.deleteTimer(timerROT);
   timer.deleteTimer(timerPRE);

  }

  void padamulang(){
    padam();
    delay(1000);
    nyala();
delay((readstring.substring(8,12)).toInt()*.075
```

Lampiran source code android file main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<FrameLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="fill_parent"
    android:gravity="center"
    android:background="@drawable/background">
    <ImageButton
        android:id="@+id/mainImageButton"
        android:layout_gravity="right"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:background="@drawable/background"
        android:src="@drawable/menu32"
        android:onClick="showPopup"
        android:contentDescription="@string/todo" />

    <GridLayout
        android:id="@+id/mainView"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:columnCount="3"
        android:gravity="center_horizontal"
        android:orientation="horizontal"
        android:paddingBottom="5dp"
        android:paddingEnd="10dp"
        android:paddingStart="5dp"
        android:paddingTop="10dp"
        android:textSize="24sp">

        <TextView
            android:id="@+id/txt"
            android:layout_columnSpan="3"
            android:layout_gravity="center_vertical"
            android:text="@string/txt1"
            android:textColor="#fff"
            android:textStyle="bold" />

        <Spinner
            android:id="@+id/cbPeriksa"
            android:layout_width="350dp"
            android:layout_height="50dp"
            android:layout_columnSpan="3"
            android:entries="@array/spn1itm"
            android:prompt="@string/spnpromt"
            />

        <TextView
            android:id="@+id/txt2"
            android:layout_column="0"
            android:layout_row="2"
            android:paddingTop="10dp"
```

```
    android:text="@string/txt2"
    android:textColor="#fff"
    android:textStyle="bold" />

<LinearLayout
    android:layout_height="wrap_content"
    android:layout_columnSpan="2"
    android:layout_gravity="fill_horizontal">

    <Spinner
        android:id="@+id/edTl"
        android:layout_width="130dp"
        android:layout_height="50dp"
        android:entries="@array/spndesimal"
        android:gravity="right" />

    <TextView
        android:id="@+id/lbcm"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/cm"
        android:textColor="#fff"
        android:textStyle="bold" />

</LinearLayout>

<TextView
    android:layout_column="0"
    android:layout_gravity="center_vertical"
    android:layout_row="3"
    android:layout_rowSpan="2"
    android:text="@string/txt11"
    android:textColor="#fff"
    android:textSize="36sp"
    android:textStyle="bold" />

<Spinner
    android:id="@+id/lbKV"
    android:layout_width="150dp"
    android:layout_height="70dp"
    android:layout_columnSpan="2"
    android:layout_rowSpan="2"
    android:entries="@array/spnkv"
    android:textStyle="bold" />

<TextView
    android:layout_column="0"
    android:layout_gravity="center_vertical"
    android:layout_rowSpan="2"
    android:text="@string/txt12"
    android:textColor="#fff"
    android:textStyle="bold" />

<TextView
```

```
    android:id="@+id/lbmAs"
    android:layout_rowSpan="2"
    android:text="0"
    android:textColor="#fff"
    android:textSize="32sp"
    android:textStyle="bold" />

<LinearLayout
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:layout_column="0"
    android:layout_columnSpan="3"
    android:layout_gravity="center_vertical"
    android:gravity="left">

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginRight="5dip"
        android:text="@string/txt13"
        android:textColor="#fff"
        android:textStyle="bold" />

    <TextView
        android:id="@+id/lbDosis"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="0"
        android:textSize="32sp"
        android:textStyle="bold" />

</LinearLayout>

<TextView
    android:layout_column="0"
    android:layout_columnSpan="2"
    android:text="@string/txt5"
    android:textColor="#fff"
    android:textStyle="bold" />

<TextView
    android:id="@+id/lbGrid"
    android:layout_gravity="left"
    android:layout_marginBottom="24dp"
    android:paddingStart="10dp"
    android:paddingTop="10dp"
    android:text=""
    android:textColor="#0f0" />

<LinearLayout
    android:layout_width="match_parent"
    android:layout_column="0"
    android:layout_columnSpan="3"
    android:layout_gravity="fill_vertical"
```

```
            android:layout_rowSpan="8"
            android:gravity="center_horizontal"
            android:orientation="horizontal"
            android:paddingStart="20dp"
            android:paddingEnd="20dp">

            <Button
                android:id="@+id/btProses"
                android:layout_width="150dp"
                android:layout_height="120dp"

                android:layout_weight="1"
                android:baselineAligned="false"
                android:paddingEnd="5dp"
                android:paddingStart="5dp"
                android:text="@string/hitung"
                android:textSize="32sp"
                android:textStyle="bold" />

            <Button
                android:id="@+id/btFoto"
                android:layout_width="150dp"

                android:layout_height="120dp"

                android:layout_weight="1"
                android:baselineAligned="false"
                android:text="@string/x_ray"
                android:textColor="#FFFFFF"
                android:textSize="32sp"
                android:textStyle="bold" />

        </LinearLayout>

    </GridLayout>

</FrameLayout>
```

Lampiran source code Arduino menu.xml

```
<menu xmlns:android="http://schemas.android.com/apk/res/android"
>

    <item
        android:id="@+id/menu_new"
        ic_menu_preferences=""
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="Baru"
   />

   <item
        android:id="@+id/menu_simpan"
        ic_menu_preferences=""
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="Simpan"

   />
   <item
        android:id="@+id/menu_cari"
        ic_menu_preferences=""
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="Cari Data"
   />

   <item
      android:id="@+id/conect_device"
        ic_menu_preferences=""
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="Open/Close Device"/>
   <item
        android:id="@+id/menu_settings"
        ic_menu_preferences=""
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="@string/menu_settings"
        android:icon="@android:drawable/ic_menu_preferences"/>

   <item
```

```
        android:id="@+id/menu_about"
        ic_menu_preferences=""
        android:orderInCategory="100"
        android:showAsAction="never"
        android:title="About"
    />

</menu>
```

Lampiran source code android file MainActivity.java

```
package com.rejekihaniflestari.ecorad3;

import android.app.*;
import android.content.*;
import android.content.res.Configuration;
import android.graphics.*;
import android.media.*;
import android.os.*;
import android.preference.*;
import android.view.*;
import android.view.animation.*;
import android.widget.*;
import android.widget.AdapterView.*;

import java.io.*;
import java.nio.charset.*;
import java.security.*;
import java.text.*;
import java.util.*;
import android.bluetooth.BluetoothAdapter;
import android.bluetooth.BluetoothDevice;

import com.google.common.collect.Iterators;
import com.google.common.io.*;

import android.widget.PopupMenu.*;

import java.lang.reflect.*;



public class MainActivity extends Activity implements
OnMenuItemClickListener
{
   EditText ednomer,ednama,edtgl;
   Spinner cbPeriksa,edTl,edST,edUdara,lbKV;
   TextView lbmAs,lbDosis,lbGrid,lbcm;
   Button btProses,btFoto,btSimpan,btBaru;

   RekamMedis rekammedis;
   Animation anim;
   ToneGenerator toneg;
   boolean databaru;
   private  Activity ini = this;
   private static final int VID = 0x2341;
   private static final int PID = 0x0043;//arduino uno
   private static UsbController sUsbController;
   protected String lampu = "0";
   //private OutputStream outputstream = null;
   private static final int RESULT_SETTINGS = 1;
   private static final int RESULT_CODE = 11;
   private ImageButton ib;
   private Calendar cal;
```

```
private int day;
private int month;
private int year;
private int dlgke=0;

public static String pemeriksaan;
public static Double dosis;
public static boolean baru;


// Debugging
 private static final String TAG = "Ekorad";
 private static final boolean D = true;

 // Message types sent from the BluetoothChatService Handler
 public static final int MESSAGE_STATE_CHANGE = 1;
 public static final int MESSAGE_READ = 2;
 public static final int MESSAGE_WRITE = 3;
 public static final int MESSAGE_DEVICE_NAME = 4;
 public static final int MESSAGE_TOAST = 5;

 // Key names received from the BluetoothChatService Handler
 public static final String DEVICE_NAME = "device_name";
 public static final String TOAST = "toast";

 // Intent request codes
 private static final int REQUEST_CONNECT_DEVICE_SECURE = 1;
 private static final int REQUEST_CONNECT_DEVICE_INSECURE = 2;
 private static final int REQUEST_ENABLE_BT = 3;

// Name of the connected device
 private String mConnectedDeviceName = null;
 // String buffer for outgoing messages
 private StringBuffer mOutStringBuffer;
 // Local Bluetooth adapter
 private BluetoothAdapter mBluetoothAdapter = null;
 // Member object for the chat services
 private BluetoothChatService mChatService = null;

private boolean terkoneksi;

public static DatabaseHandler db;



 /** Called when the activity is first created. */
 @Override
 public void onCreate(Bundle savedInstanceState)
{

     super.onCreate(savedInstanceState);
     setContentView(R.layout.main);
   final SharedPreferences sharedPrefs = PreferenceManager
         .getDefaultSharedPreferences(this);
```

```
            db = new DatabaseHandler(this);


          mBluetoothAdapter = BluetoothAdapter.getDefaultAdapter();



       edTl = (Spinner)findViewById(R.id.edTl);
       lbmAs = (TextView)findViewById(R.id.lbmAs);
       cbPeriksa = (Spinner)findViewById(R.id.cbPeriksa);
       lbKV = (Spinner)findViewById(R.id.lbKV);

       int y =0;
       do {
          lbKV.setSelection(y);
          y++;
          Toast test =
Toast.makeText(getApplicationContext(),lbKV.getSelectedItem().toS
tring(),10);
          test.show();
       }while(
!lbKV.getSelectedItem().toString().equals(sharedPrefs.getString("
prefsetkv","70")) );

       btProses = (Button)findViewById(R.id.btProses);
       lbGrid = (TextView)findViewById(R.id.lbGrid);
       lbcm = (TextView)findViewById(R.id.lbcm);
       btFoto = (Button)findViewById(R.id.btFoto);
       lbDosis = (TextView)findViewById(R.id.lbDosis);
       readUserSettings();
       enabling(false);
       btFoto.setEnabled(false);


       final AlertDialog.Builder pesanDialog = new
AlertDialog.Builder(this);
       pesanDialog.setTitle("Ekorad");
       pesanDialog.setNeutralButton("OK", new
DialogInterface.OnClickListener(){
             public void onClick(DialogInterface dialog, int p1)
             {
                //dothis;
             }
          });

       anim = new AlphaAnimation(0.0f, 1.0f);
       anim.setDuration(50);
       anim.setStartOffset(20);
       anim.setRepeatMode(Animation.REVERSE);
       anim.setRepeatCount(15);

       toneg = new ToneGenerator(AudioManager.STREAM_ALARM, 100);

       edTl.setOnItemSelectedListener(new
```

```
OnItemSelectedListener(){

            public void onItemSelected(AdapterView<?> parent,
View view, int pos, long id)
            {

               try
               {

               ((TextView) parent.getChildAt(0)).setTextSize(24);
               ((TextView)
parent.getChildAt(0)).setTextColor(Color.BLUE);
               ((TextView)
parent.getChildAt(0)).setTypeface(null, Typeface.BOLD);


                  pTl =
(Integer.valueOf(parent.getItemAtPosition(pos).toString())).intVa
lue() ;

                  lbnol();

               }
               catch (Exception ex)
               {}
            }

            }
            public void onNothingSelected(AdapterView<?> parent)
            {
               //
            }
         });

      lbKV.setOnItemSelectedListener(new
OnItemSelectedListener(){

            public void onItemSelected(AdapterView<?> parent,
View view, int pos, long id)
            {
               try {
                  ((TextView)
parent.getChildAt(0)).setTextSize(32);
                  ((TextView)
parent.getChildAt(0)).setTextColor(Color.BLUE);
                  ((TextView)
parent.getChildAt(0)).setTypeface(null, Typeface.BOLD);
```

```
                    lbnol();
                }catch (Exception ex){}
            }

            public void onNothingSelected(AdapterView<?> parent)
            {
                //
            }
        });
       cbPeriksa.setOnItemSelectedListener(new
OnItemSelectedListener(){

            public void onItemSelected(AdapterView<?> parent,
View view, int pos, long id)
            {
                try {
                    ((TextView)
parent.getChildAt(0)).setTextSize(24);
                    ((TextView)
parent.getChildAt(0)).setTextColor(Color.BLUE);
                    ((TextView)
parent.getChildAt(0)).setTypeface(null, Typeface.BOLD);


                if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Gigi"))
                {
                    lbcm.setText("mm");
                }
                else
                {
                    lbcm.setText("cm");
                }

                if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Lumbal AP"))
                {
                    edTl.setSelection(21);
                } else if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Lumbal
Lateral"))
                {
                    edTl.setSelection(27);
                }else if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Lumbo Sacral
Joint"))
                {
                    edTl.setSelection(25);
                }else if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Abdomen
AP"))
                {
                    edTl.setSelection(21);
                }else if (((TextView)
```

```
parent.getChildAt(0)).getText().toString().contains("Pelvis AP"))
                {
                   edTl.setSelection(26);
                }else if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Sendi
Panggul AP"))
                {
                   edTl.setSelection(26);
                }else if (((TextView)
parent.getChildAt(0)).getText().toString().contains("All"))
                {
                   edTl.setSelection(26);
                }else if (((TextView)
parent.getChildAt(0)).getText().toString().contains("Thorax PA"))
                {

                lbnol();
                }catch (Exception ex)
                {}
            }
            public void onNothingSelected(AdapterView<?> parent)
            {
              //
            }
        });

       int x =0;
      do {
         cbPeriksa.setSelection(x);
         x++;
      }while(
!cbPeriksa.getSelectedItem().toString().equals(sharedPrefs.getStr
ing("prefsetperiksa","Thorax PA")) );


      btProses.setOnClickListener(new View.OnClickListener(){
            public void onClick(View p1)
            {

                boolean ekpose = false;
                double
D1,D2,D3,D4,D5,D6,D7,D8,D9,D10,D11,D12,D13,D14;

                P = 15;
                V =
Double.valueOf(lbKV.getSelectedItem().toString()).doubleValue();
                A = nmAs;
                d = Double.valueOf(stjarak).doubleValue();
                E = (P * V * V * A) / (d * d);

                G = E * 0.877;

                G = (E * 0.877) / 100;
                dosis = G;
```

```
                pemeriksaan =
cbPeriksa.getSelectedItem().toString();

                if (stspeed.equals("200"))
                {
                                        if
(cbPeriksa.getSelectedItem().toString().equals("Thorax PA"))
                    {
                       D7 = 1.5;
                       if (D7 < G)
                       {
                          lbDosis.setTextColor(Color.RED);
                          lbDosis.startAnimation(anim);

toneg.startTone(ToneGenerator.TONE_CDMA_ALERT_CALL_GUARD, 1500);
                       }
                       else
                       {
                          lbDosis.setTextColor(Color.GREEN);
                          ekpose = true;
                       }
                    }
                                        if
(cbPeriksa.getSelectedItem().toString().equals("Thorax PA"))
                    {
                       D7 = 1.5;
                       if (D7 < G)
                       {
                          lbDosis.setTextColor(Color.RED);
                          lbDosis.startAnimation(anim);

toneg.startTone(ToneGenerator.TONE_CDMA_ALERT_CALL_GUARD, 1500);
                       }
                       else
                       {
                          lbDosis.setTextColor(Color.GREEN);
                          ekpose = true;
                       }
                    }

                    {
                       D14 = 7.5;
                       if (D14 < G)
                       {
                          lbDosis.setTextColor(Color.RED);
                          lbDosis.startAnimation(anim);

toneg.startTone(ToneGenerator.TONE_CDMA_ALERT_CALL_GUARD, 1500);
                       }
                       else
                       {
                          lbDosis.setTextColor(Color.GREEN);
                          ekpose = true;
                       }
```

```
            }
        }

        if (ekpose)
        {

            btProses.setTextColor(Color.YELLOW);


            if (terkoneksi)
            {

                btFoto.post(new Runnable(){
                      public void run()
                      {

                          try
                          {
                              sendMessage("PRE");
                              Thread.sleep(tundaijo);


                              btFoto.setEnabled(true);
                          }
                          catch (InterruptedException e)
                          {}
                      }
                  });
            }
            else
            {
                btFoto.post(new Runnable(){
                      public void run()
                      {

                          try
                          {
                              Thread.sleep(tundaijo);
                              btFoto.setEnabled(true);

                          }
                          catch (InterruptedException e)
                          {}


                      }

                  });

            }
            btFoto.postDelayed(murup, 6000);
        }
    }
});
```

```
        btFoto.setOnClickListener(new View.OnClickListener(){

                public void onClick(View p1)
                {
                   if (terkoneksi)
                   {

                      int tunda = (int) (nmAs * 1000) / ma;
                      int saklar = 101;
                      int count =
Long.valueOf(sharedPrefs.getString("prefjmlcount","0")).intValue(
);
                      count++;

sharedPrefs.edit().putString("prefjmlcount",String.valueOf(count)
).apply();

                      try
                      {

                         if
((cbPeriksa.getSelectedItem().toString().equals("Lumbal
Lateral"))||(cbPeriksa.getSelectedItem().toString().equals("Lumba
l AP"))) {

                            sendMessage("EXP:" + saklar + ":" + tunda
+ ":" + "2,");
                            tunda = tunda*2;
                         } else {
                            sendMessage("EXP:" + saklar + ":" + tunda
+ ":" + "1,");
                         }
                         Thread.sleep(tunda);

                      }
                      catch (InterruptedException e) {
                         Toast test = Toast.makeText(ini, "gagal
memoto", 10);
                         test.show();
                      }

                   }
                   else
                   {
                      Toast test = Toast.makeText(ini, "Bluetooth
Tidak Terkoneksi", 10);
                      test.show();
                   }
                   btFoto.setEnabled(false);
                   btProses.setTextColor(Color.BLACK);
```

```
                btFoto.removeCallbacks(murup);
                enabling(false);}

         });


        // If the adapter is null, then Bluetooth is not
supported
        if (mBluetoothAdapter == null)
      {
            Toast.makeText(this, "Bluetooth is not available",
Toast.LENGTH_LONG).show();
            finish();
            return;
        }
    }

   Runnable murup =   new Runnable(){
      public void run()
      {
         if (terkoneksi)
         {
            sendMessage(Character.toString((char)100));
         }
         btFoto.setEnabled(false);
         btProses.setTextColor(Color.BLACK);


      }};

   @Override
   public void onConfigurationChanged(Configuration newConfig) {
      // TODO Auto-generated method stub
      if (mChatService != null) mChatService.stop();

      super.onConfigurationChanged(newConfig);

   }

   @Override
   protected void onSaveInstanceState(Bundle outState) {
      if (mChatService != null) {
         outState.putString("bluetoothstate", address);
      }
      super.onSaveInstanceState(outState);


   }

   @Override
   protected void onRestoreInstanceState(Bundle
savedInstanceState) {
```

```
        super.onRestoreInstanceState(savedInstanceState);

        address =
savedInstanceState.getString("bluetoothstate",null);

            if (address != null) {
               // Get the BluetoothDevice object
               BluetoothDevice device =
mBluetoothAdapter.getRemoteDevice(address);
               // Attempt to connect to the device
               mChatService.connect(device, false);


            }


    }

    @Override
     protected void onStart()
    {

        if (!mBluetoothAdapter.isEnabled())
        {
             Intent enableIntent = new
Intent(BluetoothAdapter.ACTION_REQUEST_ENABLE);
             startActivityForResult(enableIntent,
REQUEST_ENABLE_BT);

          }
        else
        {
          if (mChatService == null) setupChat();
          }
        super.onStart();
     }

    private void setupChat()
    {



        mChatService = new BluetoothChatService(this, mHandler);
          // Initialize the buffer for outgoing messages
          mOutStringBuffer = new StringBuffer("");
     }

     @Override
     protected void onResume()
    {


        super.onResume();
```

```
    }


    @Override
    public synchronized void onPause()
   {

       super.onPause();

    }

    @Override
    public void onStop()
   {
        super.onStop();

    }

    @Override
    public void onDestroy()
   {
        super.onDestroy();
        // Stop the Bluetooth chat services
        if (mChatService != null) mChatService.stop();

    }

    private void ensureDiscoverable()
   {

        if (mBluetoothAdapter.getScanMode() !=
            BluetoothAdapter.SCAN_MODE_CONNECTABLE_DISCOVERABLE)
      {
            Intent discoverableIntent = new
Intent(BluetoothAdapter.ACTION_REQUEST_DISCOVERABLE);

discoverableIntent.putExtra(BluetoothAdapter.EXTRA_DISCOVERABLE_D
URATION, 300);
            startActivity(discoverableIntent);
        }
    }

    /**
     * Sends a message.
     * @param message  A string of text to send.
     */
    private void sendMessage(String message)
   {
        // Check that we're actually connected before trying
anything
        if (mChatService.getState() !=
BluetoothChatService.STATE_CONNECTED)
      {
```

```
            return;
        }

        // Check that there's actually something to send
        if (message.length() > 0)
      {
            // Get the message bytes and tell the
BluetoothChatService to write
            byte[] send = message.getBytes();
            mChatService.write(send);

            // Reset out string buffer to zero and clear the edit
text field
            mOutStringBuffer.setLength(0);

        }
    }

   @Override
   @Deprecated
   protected Dialog onCreateDialog(int id)
   {
      cal = Calendar.getInstance();
      day = cal.get(Calendar.DAY_OF_MONTH);
      month = cal.get(Calendar.MONTH);
      year = cal.get(Calendar.YEAR);
      return new DatePickerDialog(this, datePickerListener, year,
month, day);
   }
   private DatePickerDialog.OnDateSetListener datePickerListener
= new DatePickerDialog.OnDateSetListener() {
      public void onDateSet(DatePicker view, int selectedYear,
                  int selectedMonth, int selectedDay)
      {
         edtgl.setText(selectedDay + " / " + (selectedMonth + 1)
+ " / "
                  + selectedYear);


      }


   };

   // The Handler that gets information back from the
BluetoothChatService
   private final Handler mHandler = new Handler() {
        @Override
        public void handleMessage(Message msg)
      {
         Activity activity = ini;
            switch (msg.what)
         {
```

```
                case Constants.MESSAGE_STATE_CHANGE:
                    switch (msg.arg1)
                {
                        case
BluetoothChatService.STATE_CONNECTED:
                        terkoneksi = true;


btFoto.setBackgroundResource(R.drawable.apptheme_btn_default_holo
_light);

btProses.setBackgroundResource(R.drawable.appthemered_btn_default
_holo_light);
                        Toast.makeText(activity, "Bluetooth
Terkoneksi", Toast.LENGTH_SHORT).show();
                        break;
                        case
BluetoothChatService.STATE_CONNECTING:
                        break;
                        case BluetoothChatService.STATE_LISTEN:
                        case BluetoothChatService.STATE_NONE:
                        terkoneksi = false;

btFoto.setBackgroundResource(android.R.drawable.btn_default);

btProses.setBackgroundResource(android.R.drawable.btn_default);


                        break;
                    }
                    break;
                case Constants.MESSAGE_WRITE:
                    byte[] writeBuf = (byte[]) msg.obj;
                    // construct a string from the buffer
                    String writeMessage = new String(writeBuf);
                break;
                 case Constants.MESSAGE_READ:
                byte[] readBuf = (byte[]) msg.obj;
                // construct a string from the valid bytes in the
buffer
                String readMessage = new String(readBuf, 0,
msg.arg1);
                // construct a string from the valid bytes in the
buffer
                readmessage.append(readMessage);
                int endOfLineIndex = readmessage.indexOf("~");


                if (endOfLineIndex > 0)
                {                                            //
make sure there data before ~
                   String dataInPrint = readmessage.substring(0,
endOfLineIndex);
```

```
                    dariarduino = dataInPrint;
                    readmessage.delete(0, readmessage.length());
                    bacaparam(dariarduino);

                }

                break;
                 case Constants.MESSAGE_DEVICE_NAME:
                     // save the connected device's name
                     mConnectedDeviceName =
msg.getData().getString(Constants.DEVICE_NAME);
                     break;
                 case Constants.MESSAGE_TOAST:
                     break;
            }
        }


    };

   private StringBuilder readmessage= new StringBuilder();
   public String dariarduino="";
   private void chekparam(){
      sendMessage("RII");
   }
   private void bacaparam(String readmessage) {
      if (readmessage.contains("*")) {
         String[] dtsensor = readmessage.split("#");
         Toast.makeText(ini, dtsensor[0],
Toast.LENGTH_LONG).show();
                 SharedPreferences sharedPrefs = PreferenceManager
                .getDefaultSharedPreferences(this);

sharedPrefs.edit().putBoolean("prefeksafterrot",strangkatoboolean
(dtsensor[1])).apply();
         trsrot = strangkatoboolean(dtsensor[1]);

sharedPrefs.edit().putString("prefmakrot",dtsensor[2]).apply();
         makrotar =
Integer.valueOf(dtsensor[2].trim()).intValue();

sharedPrefs.edit().putBoolean("prefdoublema",strangkatoboolean(dt
sensor[3])).apply();
         doublema = strangkatoboolean(dtsensor[3]);

sharedPrefs.edit().putString("prefmA",dtsensor[4]).apply();
         ma= Integer.valueOf(dtsensor[4].trim()).intValue();

sharedPrefs.edit().putString("prefmA2",dtsensor[5]).apply();
         ma2 = Integer.valueOf(dtsensor[5].trim()).intValue();

sharedPrefs.edit().putString("prefremrot",dtsensor[6]).apply();
         remrot =
Integer.valueOf(dtsensor[6].trim()).intValue();
```

```
sharedPrefs.edit().putString("prefjedaeksp",dtsensor[7]).apply();
         tundaijo =
Integer.valueOf(dtsensor[7].trim()).intValue();
         readUserSettings();

      }

   }

   protected boolean trsrot,doublema;
   protected int ma,ma2,makrotar,remrot,tundaijo;
   protected boolean strangkatoboolean(String angka){
      int a = Integer.valueOf(angka.trim()).intValue();
      if (a==1) {
         return true;
      }else{
         return false;
      }
   }
   private void enabling(boolean bisa)
   {

      cbPeriksa.setEnabled(false);
      edTl.setEnabled(bisa);


   }

   private  final IUsbConnectionHandler mConnectionHandler = new
IUsbConnectionHandler() {
      @Override
      public void onUsbStopped()
      {
         L.e("Usb stopped!");

      }

      @Override
      public void onErrorLooperRunningAlready()
      {

      }

      @Override
      public void onDeviceNotFound()
      {
          }
   };
   protected int K,pTl,pST,pUdara,pG,pGen,pSpeed,pJarak;
   protected double E,G,P,V,A,d,nmAs;

   public void lbnol()
   {
```

```
    lbDosis.setText("0");
    lbDosis.setTextColor(Color.WHITE);
}

private int kV_conv(String nilaikv)
{
        int hsl;
    if (nilaikv.equals("40"))
    {
        hsl = 0;
    }
    else if (nilaikv.equals("41"))
    {
        hsl = 1;
    }
    else if (nilaikv.equals("42"))
    {
        hsl = 2;
    }
    else if (nilaikv.equals("44"))
    {
        hsl = 3;
    }
    else if (nilaikv.equals("46"))
    {
        hsl = 4;
    }
    else if (nilaikv.equals("48"))
    {
        hsl = 5;
    }
    else if (nilaikv.equals("50"))
    {
        hsl = 6;
    }
    else if (nilaikv.equals("52"))
    {
        hsl = 7;
    }
    else if (nilaikv.equals("54"))
    {
        hsl = 8;
    }
    else if (nilaikv.equals("58"))
    {
        hsl = 9;
    }
    else if (nilaikv.equals("60"))
    {
        hsl = 10;
    }
    else if (nilaikv.equals("63"))
    {
        hsl = 11;
```

```
}
else if (nilaikv.equals("66"))
{
   hsl = 12;
}
else if (nilaikv.equals("70"))
{
   hsl = 13;
}
else if (nilaikv.equals("73"))
{
   hsl = 14;
}
else if (nilaikv.equals("77"))
{
   hsl = 15;
}
else if (nilaikv.equals("81"))
{
   hsl = 16;
}
else if (nilaikv.equals("85"))
{
   hsl = 17;
}
else if (nilaikv.equals("90"))
{
   hsl = 18;
}
else if (nilaikv.equals("96"))
{
   hsl = 19;
}
else if (nilaikv.equals("102"))
{
   hsl = 20;
}
else
if (nilaikv.equals("109"))
{
   hsl = 21;
}
else if (nilaikv.equals("117"))
{
   hsl = 22;
}
else if (nilaikv.equals("125"))
{
   hsl = 23;
}
else if (nilaikv.equals("133"))
{
   hsl = 24;
}
```

```
        else if (nilaikv.equals("141"))
        {
            hsl = 25;
        }
        else
        {
            hsl = 26; //150
        }

        return hsl;
    }

    public void hitunglbmas()
    {
        K = 0;
        if
(cbPeriksa.getSelectedItem().toString().contains("Thorax"))
        {
            K = 7 + pG + pGen + pSpeed + pJarak + (int)(pTl / 2);

        }

        double[] mAs=new double[41];
        mAs[0] = 0.1;mAs[1] = 0.125;mAs[2] = 0.16;mAs[3] =
0.2;mAs[4] = 0.25;mAs[5] = 0.32;mAs[6] = 0.4;mAs[7] = 0.5;mAs[8]
= 0.63;
        mAs[9] = 0.8;mAs[10] = 1;mAs[11] = 1.25;mAs[12] =
1.6;mAs[13] = 2;mAs[14] = 2.5;mAs[15] = 3.2;mAs[16] = 4;mAs[17] =
5;
        mAs[18] = 6.3;mAs[19] = 8;mAs[20] = 10;mAs[21] =
12.5;mAs[22] = 16;mAs[23] = 20;mAs[24] = 25;mAs[25] = 32;mAs[26]
= 40;
        mAs[27] = 50;mAs[28] = 63;mAs[29] = 80;mAs[30] =
100;mAs[31] = 125;mAs[32] = 160;mAs[33] = 200;mAs[34] =
250;mAs[35] = 320;
        mAs[36] = 400;mAs[37] = 500;mAs[38] = 630;mAs[39] =
800;mAs[40] = 1000;
        int j;


        j = K - (kV_conv(lbKV.getSelectedItem().toString())) + 10;

        try
        {

            if (j < (0))
            {
                lbmAs.setText("0");
                nmAs = 0;
            }
            else if (j > 40)
            {
                lbmAs.setText("0");
```

```
                nmAs = 0;
            }
            else
            {
                lbmAs.setText(new
java.text.DecimalFormat("#.###").format(mAs[j]));
                nmAs = mAs[j];
            }

        }
        catch (Exception ex)
        {
            return;
        }

    }

    private MenuItem menusimpan;

    @Override
    public boolean onCreateOptionsMenu(Menu menu)
    {
        getMenuInflater().inflate(R.menu.settings, menu);
         menusimpan = menu.getItem(1);
        menusimpan.setEnabled(false);
        return true;
    }

    public void showPopup(View v){
        PopupMenu popup = new PopupMenu(this,v);
        popup.getMenu().setQwertyMode(true);
        popup.setOnMenuItemClickListener(this);
        popup.inflate(R.menu.settings);
        menusimpan = popup.getMenu().getItem(1);
        menusimpan.setEnabled(false);
        popup.show();
    }

    @Override
    public boolean onOptionsItemSelected(MenuItem item)
    {
        switch (item.getItemId())
        {
            case R.id.menu_new:
                menusimpan.setEnabled(true);
                baru = true;
                enabling(true);
                edTl.setSelection(0);

                //cbPeriksa.setSelection(6);
                break;
            case R.id.menu_settings:
                Intent i = new Intent(this,
UserSettingActivity.class);
```

```
            startActivityForResult(i, RESULT_SETTINGS);
            break;
         case R.id.conect_device:
            Intent b = new Intent(this,
DeviceListActivity.class);
            startActivityForResult(b,
REQUEST_CONNECT_DEVICE_INSECURE);

            break;
         case R.id.menu_cari:
            Intent c = new Intent(this, CariActivity.class);
            startActivityForResult(c, RESULT_SETTINGS);
            break;

         case R.id.menu_simpan:
            Intent e = new Intent(this, SimpanActivity.class);
            startActivityForResult(e, RESULT_SETTINGS);
            break;

         case R.id.menu_about:
            Intent d = new Intent(this, AboutActivity.class);
            startActivityForResult(d, RESULT_SETTINGS);
            break;
      }

      return true;
   }

   @Override
   public boolean onMenuItemClick(MenuItem item)
   {
      switch (item.getItemId())
      {

         case R.id.menu_settings:
            Intent i = new Intent(this,
UserSettingActivity.class);
            startActivityForResult(i, RESULT_SETTINGS);
            break;
         case R.id.conect_device:


            Intent b = new Intent(this,
DeviceListActivity.class);
            startActivityForResult(b,
REQUEST_CONNECT_DEVICE_INSECURE);

            break;
         case R.id.menu_cari:
            Intent c = new Intent(this, CariActivity.class);
            startActivityForResult(c, RESULT_SETTINGS);
            break;

         case R.id.menu_simpan:
```

```
            Intent e = new Intent(this, SimpanActivity.class);
            startActivityForResult(e, RESULT_SETTINGS);
            break;
         case R.id.menu_new:

            baru = true;
            enabling(true);
             break;
         case R.id.menu_about:
            Intent d = new Intent(this,
AboutActivity.class);startActivityForResult(d, RESULT_SETTINGS);
            break;
      }

      return true;
   }

    private String address;
   private void connectDevice(Intent data, boolean secure)
   {
         // Get the device MAC address
          address = data.getExtras()
             .getString(DeviceListActivity.EXTRA_DEVICE_ADDRESS);
         // Get the BluetoothDevice object
         BluetoothDevice device =
mBluetoothAdapter.getRemoteDevice(address);
         // Attempt to connect to the device
         mChatService.connect(device, secure);
    }


   @Override
   protected void onActivityResult(int requestCode, int
resultCode, Intent data)
   {
      super.onActivityResult(requestCode, resultCode, data);

      switch (requestCode)
      {
         case RESULT_SETTINGS:
            readUserSettings();
            break;
         case REQUEST_CONNECT_DEVICE_INSECURE:
            if (resultCode == Activity.RESULT_OK)
            {
               connectDevice(data, false);
            }
            break;
         case REQUEST_ENABLE_BT:
            if (resultCode == Activity.RESULT_OK)
            {
               setupChat();
            }
            break;
```

```
        }

    }


     protected String stgrid,stspeed,stgen,stjarak,stma;
    //protected int ma;
    private void readUserSettings()
    {
        SharedPreferences sharedPrefs = PreferenceManager
            .getDefaultSharedPreferences(this);

        stgrid = sharedPrefs.getString("prefvargrid", "tanpa
grid");
        lbGrid.setText(stgrid);
        if (stgrid.equals("tanpa grid"))
        {
            pG = 0;
        }
        else if (stgrid.equals("lysolm"))
        {
            pG = 4;
        }
        else
        {
            pG = 5;
        }
        stspeed = sharedPrefs.getString("prefvarspeed", "200");

        if (stspeed.equals("200"))
        {
            pSpeed = 4;
        }
        else if (stspeed.equals("400"))
        {
            pSpeed = 0;
        }
        else
        {
            pSpeed = -4;
        }
        stgen = sharedPrefs.getString("prefvargen", "6 pulsa");
        if (stgen.equals("6 pulsa"))
        {
            pGen = 1;
        }
        else if (stgen.equals("1 pulsa"))
        {
            pGen = 2;
        }
        else if (stgen.equals("2 pulsa"))
        {
            pGen = 2;
```

```
        }
        else if (stgen.equals("12 pulsa"))
        {
           pGen = 0;
        }
        else
        {
           pGen = 0;
        }
        stjarak = sharedPrefs.getString("prefvarjarak", "100");
        if (stjarak.equals("100"))
        {
           pJarak = 0;
        }
        else if (stjarak.equals("120"))
        {
           pJarak = 1;
        }
        else if (stjarak.equals("135"))
        {
           pJarak = 2;
        }
        else
        {
           pJarak = 3;
        }

        stma = sharedPrefs.getString("prefmA", "100");
        if (!stma.equals("") || stma != null)
        {
           try
           {
              ma = new Integer(stma).intValue();
           }
           catch (NumberFormatException e)
           {}
        }
        else
        {ma = 0;}
          int y=0;
        do {
           lbKV.setSelection(y);
           y++;
           Toast test =
Toast.makeText(getApplicationContext(),lbKV.getSelectedItem().toS
tring(),10);
           test.show();
        }while(
!lbKV.getSelectedItem().toString().equals(sharedPrefs.getString("
prefsetkv","70")) );

        int x =0;
        do {
           cbPeriksa.setSelection(x);
```

```
            x++;
        }while(
!cbPeriksa.getSelectedItem().toString().equals(sharedPrefs.getStr
ing("prefsetperiksa","Thorax PA")) );

  }}
```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Formulation of the Exposure Factor in Radiography Preparation

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ABSTRACT

In radiographs exposure, an accurate quantity of exposure factor is needed. The determination of the quantity of the exposure factor is based on measurements,and habits and experience of the medical officer. However, the situation has lead to failure of photo exposure of the radiograph. An accurate of exposure has deviated and the precision of radiation is inefficient. To addressing this problem, the determination of the quantity of the exposure factor has proposed by mathematical calculations, so that the accuracy of radiation is improved.

A formulation has been proposed to determining the exposure factor in radiograph images by conducting system point based on Siemens table. Moreover, exposure equation has development in software in order to made exposure system automatically and controlled over android phone.

The results show that by determine the exposure factors of radiation received by patients with a starting point amount of 7 points able perform well. The software able to conduct exposure factor and skin dose information was automatically. Therefore, an improvement of image

radiographs has shown an optimal quality which increases of accuracy and precision.

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1. INTRODUCTION

X-rays are equipment that is very widely used in medical circles, for diagnostic purposes as well as for screening in order to monitor the health of employees in an employing company with high health risks [1]–[6]. Examinations What is often done for medical check-ups is shooting Thorax photos or Chest photos Currently, the X-Ray equipment used is still using equipment which is also used as equipment for general examinations, which has a regulation of exposure factors consisting of kV and mAs which vary quite a lot for the purposes of shooting the whole body[7]–[12]. X-ray aircraft used today for the microcontroller unit Medical Ches Unit (MCU) use manual controls in determining the exposure factor so that the radiation level used cannot be controlled properly[9][6]. Sometimes it can be high, sometimes it can be too low and this results in the resulting image being rejected. The error of the exposure factor is very high, this is because there is no system on the x ray device that is able to determine the exact exposure factor[13]–[19] . The reality in the field is that a radiographer makes a radiograph by referring to a predetermined or written table, as a reference in carrying out exposure or shooting[20]–[25],[26]. Usually radiographers have difficulty remembering the quantity of exposure factors that have been written or labeled and have difficulty using different X-ray planes[4], [5], [9]. The data from the table is also not from mathematical calculations, but based on experience and guesswork, so it really depends on feelings [9], [15], [27]–[29]. Based on the data obtained in the field, the occurrence of reject or rejection of films by 60% is due to an error in the quantity of the exposure factor With the occurrence of repeated photos, the dose received by the patient will increase, and this also makes the costs incurred

even more [8], [14], [30]–[32]. The making of this android-based expression factor formulation aims to implement the calculation of the exposure factor empirically which is applied as software in Android[3], [15], [16], [29], [32], [34], [35], so that in setting the quantity of the exposure factor it can be determined precisely and finally can produce a radiograph that has optimal quality, controlled radiation dose and reduce Radiograph failure rate due to determination of exposure factors to support the diagnosis [18], [23]–[25] . An exposure factor calculator can be made for Lung Medical Check ups using mathematical calculations of experimental research results applied in making software so that it can help radiographers in determining the quantity of exposure factors, so that the quality of radiographs produced is more optimal and varied [4], [15], [17], [37]. So that it can reduce radiation exposure in patients and more so to workers the constellation of faulty expositional factors [19], [38].

2. PROPOSED SYSTEM MODEL

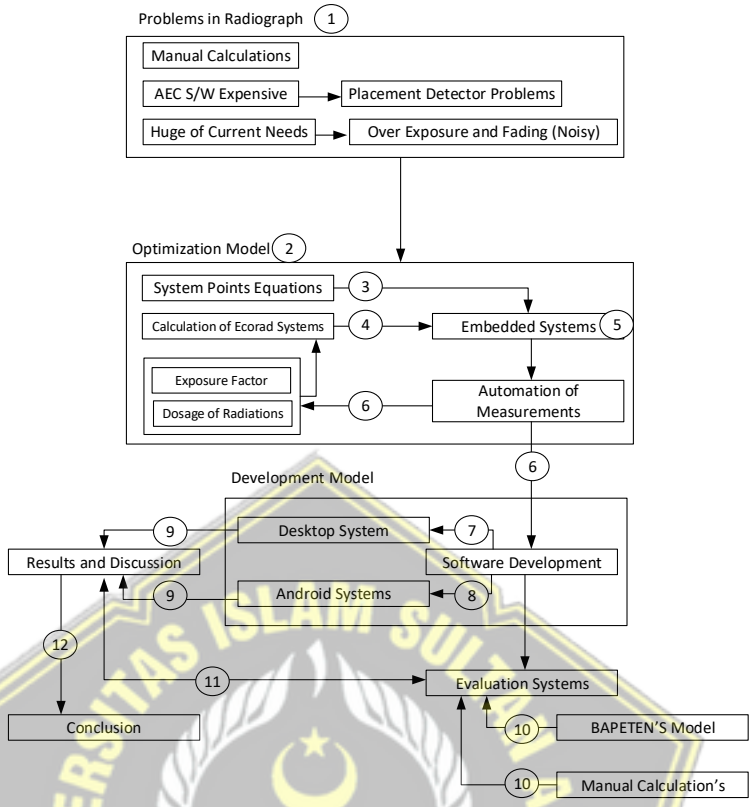


Figure 1. A Proposed of System Model of Optimization Exposure Factor and Dosage Radiation based on System Points of Framework model

Description of the stages of the system models state as follows:

1. The problem of determining exposure factors in radiography services is due to the absence of a simple and easy calculation technique in use. So that the manufacture of control of radiographic equipment using manual and automatic systems is a problem with very large dosages and electricity current requirements.

2. It is necessary to optimize the irradiation factor that is able to provide ease of use, be accurate and reduce unnecessary radiation dosages which will impact the use of electrical power is decreased.

3. The data on the system points is developed by making the number of points on bone shoots 1 cm as reference. 1-cm bone of shooting thickness has been used for a basis measurement object of making the ECORAD equation.

4. In order to define an accurate exposure factor and irradiation, the calculation of the exposure factor is formulated based on the system points equation.

5. The ECORAD equation is developed based on system points parameter which is deployed in a software system in the Android platform.

6. An automation of the proposed software able measurements of the kV and mAs exposure factors automatically. A skin dosage information can be measured in the proposed software systems.

7. Software has been developed in the desktop and android platform.

8. Software has been developed in the desktop and android platform.

9. Results and discussion of the proposed model has been carried out in this stage.

10. Performance evaluation has been compared based on BAPETEN's standard measurement and manual calculation based on system points equations.

11. Exposure factor value with the estimated dosage produced is still below the level of the provisions of BAPETEN has been verified in order to check the results of the measurements.

12. The conclusion of this study is that the Ecorad formulation is able to provide information on exposure factors that produce good radiographs image with the use of dosages that are under the provisions of the regulatory agency (BAPETEN's).

To determine the quantity of the exposure factor in the radiodiagnostic image unit, a system points equations and software has been proposed and developed which referred as *ECORADE* software. This software has provided information that able to determine the quantity of the exposure factor and information on the radiation dose that received by the patient based on system points equations. The Points System software is made in a user friendly form and display.

The points system software (Ecorade) design has comprises of (as shown in Figure 2):

a. Patient data which consists of the radiological examination number, date of examination, patient name, and type of examination.

b. Determination of the quantity of the exposure factor

This information is used to determine the quantity of the exposure factor in making radiograph images in the radiodiagnostic unit, consisting of:

a. Bone variable, this variable is intended as a data entry for bone thickness, then the program immediately processes the point value for the bone variable.

b. Soft tissue variable (soft tissue) By entering the soft tissue thickness data, the user can immediately see the point value for the soft tissue.

c. Air variable, after entering the air thickness data, the program will display the point value for the air.

d. Grid variable, in this variable, you can choose how to use the grid, then the program will display the point value for the grid variable. There are several options for grid variables including: no grid, lysolm, and bucky.

e. Variable film speed, in this variable, there are several options for the variable speed film. Among others, the 200, 400, and 600 speeds correspond to the speed of the film used when making radiograph images.

f. Generator variable, in this variable, there are several options for the use of the generator according to the type of generator on the X-ray aircraft used.

g. The generator variable options are multipulse, 6 pulses, and 12 pulses.

h. Distance variable. This variable is intended for the choice of distance use (FFD) at the time of making a radiograph image.

The parameters are formulated, in order to obtain the results of the large quantity of the exposure factor consisting of voltage (kV), tube current and required irradiation time (mAs). The determination of the quantity of the exposure factor is calculated based on the standard terms of exposure which refer to the Conversion Points of Expansion Table (Siemens, 1996). The following proposed equation as follows:

K = points x1 + points x2 + points x3 + points x4 + points x5 + points x6 + points x7 …….. (1)

Where:

K = Total points

x1 = Thickness of the Bone

x2 = Soft tissue thickness

x3 = Thickness of Air

x4 = Grid conversion factor (lysolm or bucky)

x5 = Intensifying Screen conversion factor

x6 = Generator conversion factor

x7 = FFD conversion factor

This equation is embedded in the proposed sofware and a Delphi language has been used in order to developing system point software (Ecorade).

3. Systems Points Proposed Software

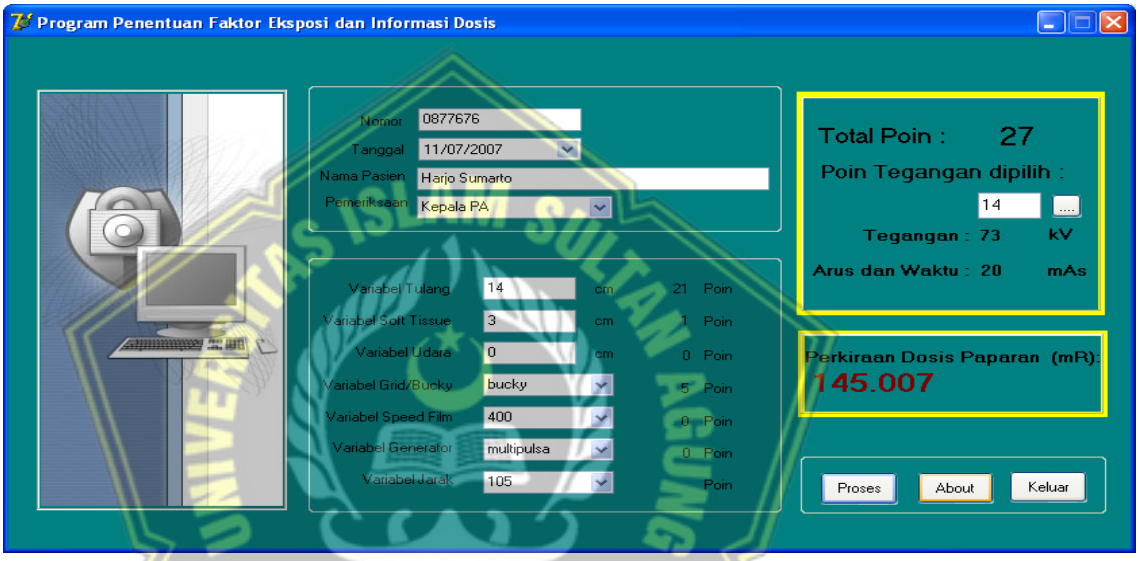


Figure 2. The Display of the Calculation Form for Determining the Quantity of the Expansion Factor in ECORADE Software Systems

Figure 2 has shown exposure factor and dosage information of the systems point parameters. Those model is proposed for lungs and thorax photograph radiations. The proposed software measured automatically which produce of total point that are needed and dosage of radiations. The system points are x1 = Thickness of the Bone; x2 = Soft tissue thickness; x3 = Thickness of Air; x4 = Grid conversion factor (lysolm or bucky); x5 = Intensifying Screen conversion factors; x6 = Generator conversion factor; x7 = FFD conversion factor. Has been displayed and fulfil by the values of Siemens Table. Therefore, total point has comeout with a value of volateg needed and doage of radiation. The factor of exposure value of the kV variable points according the image needs. Moreover, the proceed of propose value has produce irradiation factor (in kV), and the estimated skin dose (in mAs).

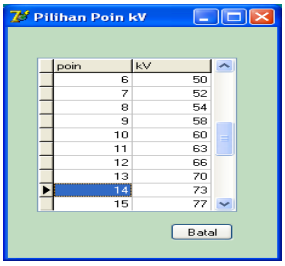


Figure 3. Display of the expression point conversion table form

No.	Checking Types	Results					
		Calculation by Software (AEC)			**Manual Calculation**		
		Total Points	Voltage (kV)	Current and Time (mAs)	Total Points	Voltage (kV)	Current and Time (mAs)
1	Cervical AP	21	60	12	21	60	12
2	Lumbosacral Lat	30	85	20	30,5	85	20
3	Cruris AP	15	60	3,2	15	60	3,2
4	Thoracolumbal AP	22	77	5	22,5	77	5
5	Thoracolumbal Lat	28	90	10	28,5	90	10
6	Abdomen AP	25	85	6,3	25	85	6,3
7	Cranium AP	27	81	12,5	27,5	81	12,5
8	Cranium Lat	23	77	6,3	23,5	77	6,3
9	Pelvis AP	25	85	5	25,5	85	6,3
10	Antebrakhi AP	12	50	4	12	50	4

Information on the estimated dosage of radiation received by the patient has comeout in Figure 3. The Points System software provides information on the estimated dose received by the patient. By pushed the "process" button, the dosage information is displayed in the Points System software as well as.

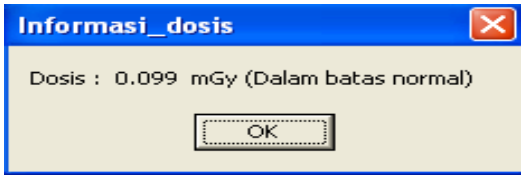


Figure 4. Display of Information Form for Estimating Dose of Radiation Received by Patients

Figure 4 has shown the display of estimating dosage of radiation received by patients, it is amounting of 0.099 mGy which is within in limits and below the allowable dosage, for example for a lungs photo of 0.4 mGy.

4. RESULTS AND ANALYSIS

Determination of the quantity of the exposure factor by measuring the thickness of the object on the patient to be examined and then entering the parameters that support the determination of the quantity of the exposure factor, then the total points will be obtained, as a basis for calculating the quantity of the exposure factor. After getting the total points, the tube voltage (kV), tube current and irradiation time (mAs) can be determined precisely.

Table.1. The Results of Points System Testing with Phantom Objects. The AEC software system has compared with the applications.

Table 2 has shown, the exposure factor obtained from the calculator application (AEC) is compared with the calculation of the same formula but manually without the application. The results has obtained the same factor of exposure amongs proposed systems, AEC software and manual calculation.

Table 2. The Results of Points Systems Testing with Patient Objects

Table 3. The Results for Determination of the Quantity of the Expression Factor in the Points System Program based on Patient Objects in Radiology

NO.		TYPE OF PMX	TESTING SYSTEM POINTS PARAMETERS	RESULTS

	PATIENT'S NAME		Tot T	TT	TJ	TU	FG	FS	FGE	FJ	Tot Poin	Teg. (kV)	A (mAs)
1	Ny. X	Cervical AP	12	6	6	-	bucky	400	multipuls	105	21	60	12
2	Ny. XX	Lumbosacral Lat	28	9	19	-	bucky	400	multipuls	105	30	85	20
3	Tn. Y	Cruris AP	8	8	-	-	tanpa	400	multipuls	105	15	60	3
4	Tn. YY	Thoraco lumbal AP	12	9	3	-	bucky	400	multipuls	105	22	77	5
5	Tn. YY	Thoraco lumbal Lat	24	9	15	-	bucky	400	multipuls	105	28	90	10
6	Ny. XY	Abdomen AP	16	10	6	-	bucky	400	multipuls	105	25	85	6,3
7	Tn. XyX	Cranium AP	17	14	3	-	bucky	400	multipuls	105	27	81	12,5
8	Tn. XyX	Cranium Lat	13	10	3	-	bucky	400	multipuls	105	23	77	6,3
9	Tn. XyX	Pelvis AP	17	10	7	-	bucky	400	multipuls	105	25	85	6,3
10	Tn. XyX	Antebrakhi AP	5	5	-	-	tanpa	400	multipuls	105	12	50	4

Where:

Tot T = Total Thickness (cm)

TT = Thickness of bone (cm)

TJ = Thickness of soft tissue cm)

TU = Thickness of air (cm)

FG = Grid conversion factor

FS = Speed conversion factor

FGE Generator conversion factor

FJ = Distance conversion factor

Table 3 has shown the results of determining the quantity of the exposure factor, it was

No.	Thick (cm)	Results								
		Proposed Points System			**Auto Exposure Calculation**			**Manual Calculation**		
		Total Points	Voltage (kV)	Current and Time (mAs)	Total Points	Voltage (kV)	Current and Time (mAs)	Total Points	Voltage (kV)	Current and Time (mAs)
1	5	11	48	4	11	50	3,98	11	48	4
2	6	12	42	10	12	42	9,65	11.5	42	10
3	7	13	50	5	13	50	5,55	13	50	5

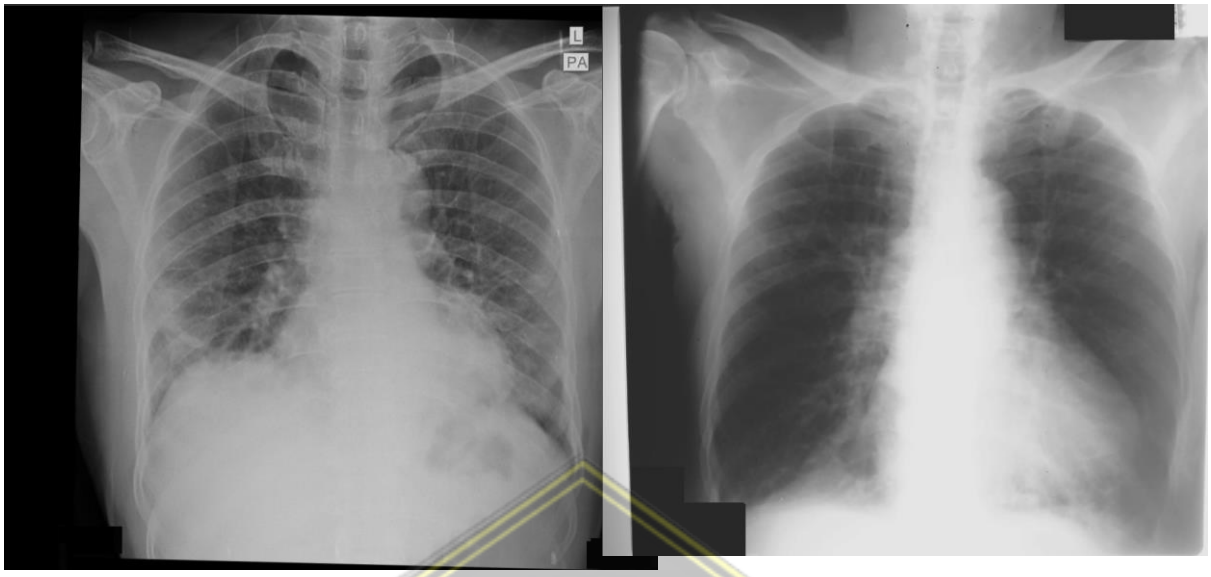
obtained the amount of voltage (kV), tube current and irradiation time (mAs) used for

making radiograph images. The program has proceeded it to obtain information on the amount of radiation dose received by the patient approximately. If the dosage is within normal limits, the information "still within normal limits" is appeared. This information is obtained from the Dosage Guidelines for BAPETEN Radiodiagnostic Patients.

Table 4. The Results of Comparative Testing on the Estimated Dosage of Radiation Received by Patients

NO	PATIENT'S NAME	CHECKING TYPES	RESULTS	
			BAPETEN *(mGy)*	**PROPOSED SYSTEM POINTS *(mGy)***
1	Ny. X	Cervical AP	5	0,539
2	Ny. XX	Lumbosacral Lat	30	1,725
3	Tn. Y	Cruris AP	0,9	0,138
4	Tn. YY	Thoraco lumbal AP	7	0,354
5	Tn. YY	Thoraco lumbal Lat	20	0,967
6	Ny. XY	Abdomen AP	10	0,544
7	Tn. XyX	Cranium AP	5	0,974
8	Tn. XyX	Cranium Lat	3	0,446
9	Tn. XyX	Pelvis AP	10	0,431
10	Tn. XyX	Antebrakhi AP	0,7	0,119

It can be seen Table 4 shows that the proposed software and equation more accurately and able to determine the quantity of the exposure factor consisting of voltage (kV), tube current and irradiation time (mAs) precisely. Therefore, the image quality of the proposed model is improved and has a good quality. Moreover, the good image quality is able to improve diagnostic analysis by the physician. As an example, for the *Cervical AP* photos in BAPETEN calculation has pointed of 5 mGy value while using system points has resulted of 0.539. Therefore, a system points more efficienct and effective compared than BAPETEN's calculation model. Moreover, a Point System software able to provide an accurately information by approximately the amount of radiation dosage that should received by the patients. Therefore, the hazard to the patient able to avoided, and the physician officer could evaluate immediately if the dosage is outside the standard provisions of BAPETEN's radiodiagnostic patient dosage guideliness.



(a) An Image using Ecorade System Points Software with 70 kV and the thickness of 24 cm mAs

(b) An Image without System Points Software with 70 kV and the thickness of 24 cm mAs

Figure 5. The comparison of quality image of radiograph which apllied of System Points Model and without System Points Model.

Figure 5 has shown the comparative model of using ecorade system points software that applied system points equation and without system points model. As seen, the image of (a) has a good image quality with a clear image and high resolution of pixel. Whereas image (b) has resulted in unclear image, reduced resolution and low image resolutions. Therefore, by applied of system points model in a software, able to improve image quality, highly gained resolution and more accurately.

5. CONCLUSION

Based on the proposed model, a system point has involved and embedded in software development which able to measure exposure factor and dosage radiations information accurately. Optimal quality of image has been achieved by applying of system points parameters into a software. Based on questionare of the physician officer, a satisfaction image quality has been optimal with conditional of strongly agree has pointed to 62% and agree has reach 32%. Moreover, the proposed software has been simplifying the quantifying of exposure factor without error and more accurate and minimize of voltage and current uses. In a future, ANN and Artificial Intelligence able to deployed in order to gain highly precision of image based on system points parameters.

6. ACKNOWLEDGEMENTS

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Deskripsi

METODE OPERASIONAL PESAWAT SINAR-X PORTABLE SINGGLE KV AUTOMATIK EKSPOSI KONTROL SYSTEM ECORAD PEMERIKSAAN FOTO PARU PARU

Bidang Teknik Invensi

Invensi ini berhubungan dengan operasional pesawat sinar-X portable dengan mikrokontroler sehingga dapat dikendalikan dari program komputer atau android, sehingga meminimalisir penggunaan sinar-X untuk mendapat manfaat yang optimal.

Latar Belakang Invensi

Sinar-X yang dihasilkan oleh pesawat sinar-X sangat dibutuhkan di Indonesia terutama terkait dengan pelayanan kesehatan maupun pelayanan yang lain. Sinar-X ini bisa digunakan dalam berbagai bidang mulai dari bidang kesehatan, bidang pendekteksian barang di bandara, sampai pada bidang industri.

Teknik pembuatan kontrol pesawat sinar-X selama ini menggunakan sistem pengendali dengan pemilihan tegangan yang disalurkan ke kumparan primer trafo tegangan tinggi menggunakan kontaktor tunggal yaag disuplay oleh a*uto tranformator* yang dapat dipilih dengan tampilan analog maupun digital. Acuan penentuan faktor ekposi pada pesawat sinar-X dapat dilakukan dengan 4 cara yaitu dengan manual dengan table ekposi, *anatomical program* dan *automatic exposure control (AEC)*. Sehingga akurasinya sangat tergantung dengan operator kecuali AEC.

Sistem kontrol yang mempunyai akurasi tinggi adalah dengan menggunakan AEC atau *automatic Exposure Control* dimana sistem ini menggunakan detektor ION TOMAT untuk menghentikan sinar-X. Sesuai dengan kebutuhan sebuah pemotretan.

Paten yang dijadikan pembanding adalah paten bernomor 10136874 dengan pemilik paten oleh Dong Kook Han dan dengan judul X-ray Imaging

Apparatus, Invensi ini berhubungan dengan aparatus pencitraan sinar-X yang mencakup sumber tegangan bias yang memberikan tegangan bias ke piksel yang mendeteksi sinar-X dan unit pemrosesan kontrol eksposur otomatis (AEC) yang mendeteksi arus yang mengalir di antara tegangan bias sumber dan piksel dan mengeluarkan sinyal AEC kelemahan dari invensi ini pada penempatan detektornya yang akan berdampak pada gambar dan kelebihan dosis radiasi.

Paten yang dijadikan pembanding adalah paten bernomor 10555714 dengan pemilik paten Tomoharu Okuno dengan judul X-rau Imaging Device, Disediakan peralatan pencitraan sinar-X yang mampu melakukan kontrol eksposur otomatis dengan benar dan kontrol pencitraan sinar-X yang bekerja dengan baik dengan konfigurasi sederhana. Dalam kasus di mana terdapat sejumlah bidang pengambilan foto AEC untuk eksposur otomatis, berdasarkan informasi posisi pada area iradiasi sinar-X dan bidang pengambilan foto AEC, ada atau tidak adanya bidang pengambilan foto AEC di mana semua area area sensitif tidak termasuk dalam area iradiasi sinar-X yang terdeteksi. Dalam kasus di mana terdapat satu atau lebih bidang pengambilan foto AEC yang tidak termasuk dalam area penyinaran sinar-X, bidang pengambilan foto AEC yang sesuai diatur untuk tidak digunakan. Akibatnya, dimungkinkan untuk melakukan kontrol eksposur otomatis dan/atau melakukan kontrol pencitraan sinar-X secara tepat dengan struktur sederhana. Kelemahan pada paten ini juga masih menggunakan Detektor untuk AECnya sehingga permasalahan muncul pada penempatan detector yg tidak dapat dilakukan secara outomatis

paten yang dijadikan pembanding adalah paten bernomor 20190090839 X-ray Imaging Device, disediakan peralatan pencitraan sinar-X yang mampu melakukan kontrol eksposur otomatis dengan benar dan kontrol pencitraan sinar-X yang berkinerja tepat dengan konfigurasi sederhana. Dalam kasus dimana terdapat sejumlah bidang pengambilan foto area iradiasi sinar-X dan bidang pengambilan foto AEC, ada atau tidak adanya bidang

pengambilan foto AEC, dimana semua area-area sensitif tidak termasuk dalam area iradiasi sinar-X yang lebih terdeteksi. Dalam kasus dimana satu atau lebih bidang pengambilan foto AEC yang tidak termasuk dalam area penyiaran sinar-X, bidang pengambilan foto AEC yang sesuai diatur untuk tidak digunakan. Akibatnya, dimungkinkan untuk melakukan kontrol eksposur otomatis dan/atau melakukan kontrol pencitraan sinar-X secara tepat dengan struktur sederhana.

Berdasarkan permasalahan yang diuraikan di atas, maka diperlukan suatu penentuan faktor eksposi pada pesawat sinar -X, tanpa mengunakan detektor agar mendapatkan porsi radiasi yang optimal, sehingga akurasi keberhasilan pemotretan menjadi sangat meningkat.

Uraian Singkat Invensi

Invensi ini bertujuan untuk memberikan akurasi faktor eksposi saat pemotretan radiografi paru paru untuk medikal cek up yang akan diperiksa dan dihitung oleh mikrokontroler, sehingga menampilkan hasil perhitungan pada komputer atau android berupa data pemilihan tegangan tabung X-ray (kV) (1) pada Gambar 1, *mili Ampere Second* (mAS) dan dosis penyinaran untuk melakukan penyinaran X-ray sesuai dengan data yang ditampilkan.

Uraian Singkat Gambar

Gambar 1, adalah gambar *flowchart* metode operasional pesawat sinar-X.

Uraian Lengkap Invensi

Dari Invensi ini dapat dilakukan penentuan faktor ekposi kV sesuai dengan keluaran pesawat sinar-X (1) Gambar 1, penentuan ini menggunakan alat ukur kV meter untuk mendapatkan nilai kV yang akan diinputkan ke android untuk mendapatkan porsi radiasi yang optimal sehingga akurasi keberhasilan pemotretan menjadi sangat meningkat. Metode yang digunakan

dengan menggunakan invensi ini yang sudah dimasukkan pada sebuah aplikasi program pada komputer sebagai sistemnya dan mikrokontroler (3) pada gambar 1 sebagai eksekutornya sehingga radiasi yang digunakan untuk pemotretan radiografi menjadi akurat dan optimal dengan menginputkan data ketebalan obyek (2) Gambar 1 maka komputer akan menghitung berapa radiasi yang dibutuhkan pada pemotretan sebuah obyek.

Kemudian juga pada teknik pemberian tegangan input ke trafo tegangan tinggi langsung dari tegangan 220V dari PLN ke Trafo tegangan tinggi menggunakan kontaktor sebanyak 1 kontaktor (4) pada Gambar 1 atau tegangan tabung tunggal.

Pembuatan invensi ini digunakan untuk menentukan kuantitas faktor eksposi pada citra radiograf di unit radiodiagaostik telah dilakukan dengan melakukan penelitian, yang selanjutnya dibuat programnya disebut program sistem poin, bertujuan memberikan informasi yaitu penentuan kuantitas faktor eksposi dan informasi dosis penyinaran yang diterima pasien.

Sebagaimana pada gambar 1 yang menerangkan metode operasional pesawat sinar-X berbasis mikrokontroler, sehingga pesawat sinar-X dapat dikontrol melalui komputer atau android dengan menentukan pilihan ketebalan objek (2) pada Gambar 1 ke dalam program komputer atau android, kemudian secra outomtis android akan menghitung faktor eksposi, sehingga menampilkan hasil perhitungan pada komputer atau android (berupa data pemilihan tegangan tabung X-ray (kV), mili Ampere Second (mAS) dan dosis penyinaran, yang mana tegangan tabung X-ray (kV) (1) pada Gambar 1 bisa disesuaikan tergantung kebutuhan pengguna, dan setelah data yang telah dihitung masuk ke dalam komputer atau android menjadi perangkat yang siap untuk melakukan penyinaran X-ray sesuai dengan data yang ditampilkan.

Hasil pengujian program sistem poin antara lain berdasaran penentuan kuantitas faktor eksposi, yang mengukur ketebalan obyek pada pasien yang akan diperiksa kemudian memasukkan parameter yang mendukung untuk penentuan kuantitas faktor eksposi, maka akan didapatkan total poin, sebagai dasar dalam menghitung kuantitas faktor

eksposi. Setelah mendapatkan total poin maka didapatkan besarnya tegangan tabung (kV) (1) pada Gambar 1, arus tabung dan waktu penyinaran (mAs) dapat ditentukan dengan tepat.

Tabel 1 Hasil Pengujian Dengan Pantom

No	Tebal (cm)	Hasil					
		Sistem Poin			AEC Auto Eksposure		
		Total Poin	kV	mAs	Total Poin	kV	mAs
1	5	11	48	4	11	50	3,98
2	6	12	42	10	12	42	9,65
3	7	13	50	5	13	50	5,55

Tabel 2 Hasil Pengujian Sistem Poin Dengan Obyek Pasien

NO	NAMA PASIEN	JENIS PMX	HASIL		
			Tebal	Teg (kV)	mAs
1	pasien A	Thorax	25	70	12,5
2	pasien B	Thorax	30	70	25
3	pasien C	Thorax	35	70	40
4	pasien D	Thorax	20	70	8
5	pasien E	Thorax	15	70	4

Penentuan selanjutnya adalah berlandaskan informasi perkiraan dosis penyinaran yang diterima pasien, yan mana jika diketahui hasil penentuan

kuantitas faktor eksposi, akan didapatkan besarnya tegangan (kV)(1) pada Gambar 1, arus tabung dan waktu penyinaran (mAs) yang digunakan untuk pembuatan citra radiograf. Kemudian pengguna dapat melanjutkan dengan memilih tombol "proses", maka program akan mengolah untuk mendapatkan informasi perkiraan besarnya dosis penyinaran yang diterima pasien. Apabila besarnya dosis masih dalam batas normal maka akan muncul informasi "masih dalam batas normal". Informasi tersebut didapatkan dari Pedoman Dosis untuk Pasien Radiodiagnostik.

Tabel 3 : Hasil Pengujian Informasi Perkiraan Dosis Penyinaran Yang Diterima Pasien Pada Program Sistem Poin

NO	NAMA PASIEN	JENIS PEMERIKSAAN	HASIL	
			BAPETEN (mGy)	SISTEM EKORAD (mGy)
1	pasien A	Thorax	0,4	0,100
2	pasien B	Thorax	0,4	0,125
3	pasien C	Thorax	0,4	0,150
4	pasien D	Thorax	0,4	0,100
5	pasien E	Thorax	0,4	0,090

Maka kita dapat memperhitungkan kalkulasi nilai poin untuk suatu obyek pemotretan, dimana total nilai poin suatu obyek yang nantinya poin ini dijadikan perhitungan variasi faktor Eksposi pada organ tersebut. Dengan persamaan dibawah ini dapat dilakukan penentuan variasi faktor ekposi: TP = DJ + X2 + X3 + JC4 ..... X13 ……. (2.3)

Dalam hal ini :

TP = Total poin

DJ = konstanta dengan nilai 7

x1 = Tebal Tulang

x2 = Tebal Jaringan lunak

x3 = Tebal Udara

x4 = Faktor konversi grid Lysolm atau bucky

x5 = Faktor konversi Intensifying Screen

x6 = Faktor konversi Generator

x7 = Faktor konversi SID (FFD)

x8 = Gibs

x9 = Film (speed Film)

x10 = Kondisi prosesing film

x11 = Image Plate

x12 = Tebal meja (nilai atenuasi meja)

x13- dst dapat disesuaikan kondisi di center Radiagrafi

Dengan mengacu total poin yang sudah didapat, maka diperolehlah besarnya tegangan, arus tabung dan waktu penyinaran yang dibutuhkan.

Contoh: pemeriksaan Manus: Dengan data sebagai berikut :

- **Tebal Obyek =22 cm**
- **Tulang 3 cm =3 poin**
- **Jar lunak 0 cm =6 poin**
- **Udara 0 cm =13 poin**
- **Grid (non) =0 poin**
- **I S 400 =0 poin**
- **Generator 6 pulsa =0 poin**
- **FFD 100 cm =0 poin**
- **Gibs (non) =0 poin**
- **Film (speed) 400 =0 poin**
- **Prosesing Film =0 poin**

Dari data diatas didapat hasi) TP (total Poin) sebesar : 29 poin

Dari TP sebesar 29 poin tersebut dapat dibuat variasi faktor eksposi sebagai berikut :

Tabel 4: Contoh pemeriksaan thorax

No	kV	mA	S	mAs	Total Point	Dosis mGy
1	60	100	0.2	20	29	0,42
2	66	100	0,125	12,5	29	0,32
3	70	100	0,1	10	29	0,29
4	77	100	0,063	6,3	29	0,22
5	81	100	0,05	5	29	0,12
6	85	100	0,04	4	29	0,17
7	90	100	0,032	3,2	29	0,15
8	96	100	0,025	2,5	29	0,13
9	102	100	0,02	2	29	0,12

Pemrograman ini didasarkan dari hasil formulasi:

TP = DJ + x1 + x2 + x3 + x …. dst

Prinsip pada proteksi radiasi adalah untuk menjamin dosis yang diterima seseorang serendah mungkin, sesuai dengan kebutuhan dan tidak melebihi nilai batas dosis yang yang ditentukan. Hal tersebut dapat dicapai dengan berbagai cara salah satunya adalah dengan penentuan kuantitas faktor eksposi secara tepat. Dengan menentukan kuantitas faktor eksposi secara tepat maka diharapkan dapat menghasilkan gambaran radiograf yang optimal untuk mendukung diagaosa, sehingga terjadinya penolakan film dapat berkurang, karena dengan pengulangan foto maka dosis yang diterima pasien semakin bertambah.

Kesimpulan dapat dibuat invensi ini adalah untuk menghitung faktor eksposi penentuan kuantitas faktor eksposi yang terdiri dari tegangan (kV) (1)

pada Gambar 1, mAs (arus tabung dan waktu penyinaran). Berdasarkan rumus penentuan variasi faktor ekposi yang diuraikan di atas, didapati program kalkulasi faktor ekposi dengan ditambahkan informasi dosis penyinaran (2) pada Gambar 1 yang diterima pasien, sehingga dapat membantu mempermudah pengaturan kuantitas faktor eksposi sehingga diharapkan terjadinya pengulangan foto dapat ditekan sekecil mungkin.

Invensi ini memerlukan program/software yang sudah dibuat dapat mengaplikasikan sistem yang dihubungkan dengan generator sinar-X sehingga dapat terintegrasi dengan *Personal Computer* (PC).

Klaim

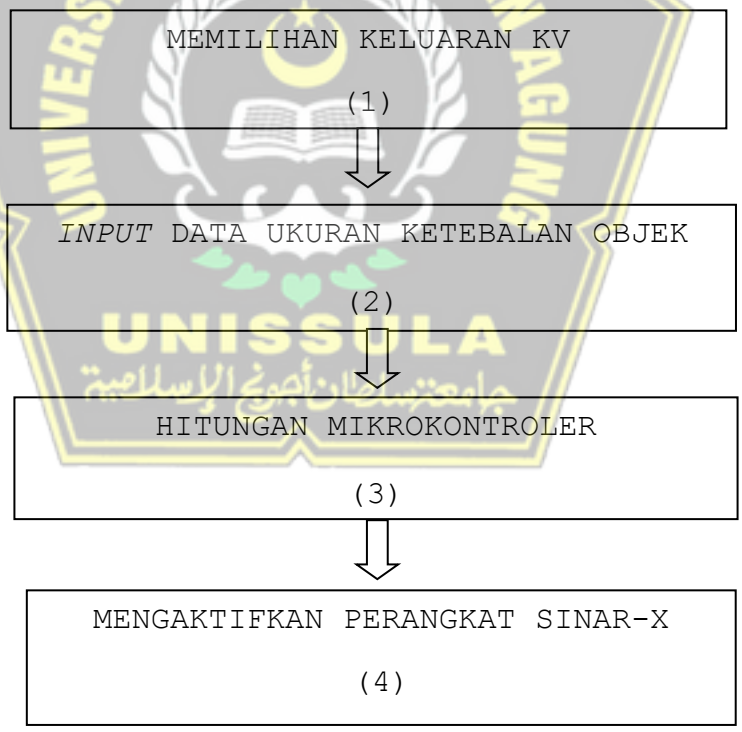
1. **Suatu metode operasional pesawat sinar-X berbasis mikrokontroler, sehingga pesawat sinar-X dapat dikontrol melalui komputer atau android untuk akurasi faktor eksposi saat pemotretan radiografi, yang terdiri dari:**
   - **memilihan anatomi yang akan diperiksa dengan menentukan pilihan objek dan ketebalan objek ke dalam program komputer atau android;**
   - **memasukkan data berupa ukuran ketebalan objek untuk dihitung oleh mikrokontroler, sehingga menampilkan hasil perhitungan pada komputer atau android berupa data pemilihan tegangan tabung *X-ray* (kV) (1) Ganbar 1 , *mili Ampere Second* (mAS) dan dosis penyinaran, yang mana tegangan tabung *X-ray* (kV) bisa disesuaikan tergantung kebutuhan pengguna;**
   - **data yang telah dihitung masuk (2) Gambar 1ke dalam komputer atau android menjadi perangkat yang siap untuk melakukan penyinaran X-ray sesuai dengan data yang ditampilkan.**

Abstrak

METODE OPERASIONAL PESAWAT SINAR-X

BERBASIS MIKROKONTROLER

Invensi ini berhubungan dengan operasional pesawat sinar-X yang dikendalikan melalui mikrokontroler sehingga dapat dikendalikan dari program komputer atau android, sehingga meminimalisir penggunaan sinar-X untuk mendapat manfaat yang optimal dan bertujuan untuk memberikan akurasi faktor eksposi saat pemotretan radiografi didapat dari perhitungan poin untuk ketebalan obyek thorax yang akan diperiksa dan dihitung oleh mikrokontroler, sehingga menampilkan hasil perhitungan pada komputer atau android berupa data pemilihan tegangan tabung X-ray (kV), *mili Ampere Second* (mAS) dan dosis penyinaran untuk melakukan penyinaran X-ray sesuai dengan data yang ditampilkan.



Gambar 1. FLOWCHART METODE OPERASIONAL PESAWAT SINAR-X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