CHAPTER V
IMPLEMENTATION AND TESTING

5.1 Implementation

5.1.1. Implementation on Convert Image Number Notation to Sound :

This application has 5 step the step is :

5.1.1.1. Set String with number :

5.1.1.2. Create image from that string number :

CiptaGambar is call the constructor off Buffer class to make string become image

```java
public class Buffer //extends JFrame
{   private BufferedImage img ;
    private String str;

    public static int cekSpace(final String testCode){
    int countspace=0;
    if(testCode != null){
        for(int i = 0; i < testCode.length(); i++){
            if(Character.isWhitespace(testCode.charAt(i))){
                countspace=countspace+1;
                //System.out.println(countspace);


            }
        }
    }
    return countspace;
    }

    public Buffer(String nA)
    {
        int fontSize=10;
        str = new String(nA);

        int panjangkata= str.length()-cekSpace(str);
        Font font = new Font("Arial", Font.PLAIN, fontSize);
        img = new BufferedImage(fontSize * panjangkata, fontSize, BufferedImage.TYPE_4BYTE_ABGR);
        Graphics g2 = img.createGraphics();
        g2.fillRect ( 0, 0,img.getWidth(),img.getHeight() );
        g2.setColor(Color.black);
        g2.setFont(font);
        //g2.drawString("1 4 | 5 1 5 3 | 5 . . 2 3 | 4 2 5 3 | 8 . . 1 1 | ", 2,10);
        g2.drawString(str, panjangkata,fontSize-1);
        g2.dispose();

        try
        {
            ImageIO.write(img, "png", new File("gambar-latih.png"));
        }
        catch(Exception e)
        {

        }


    }
}
```

The image has been created from that String:

1 2 3 4 3 4 2 1 1 3 4 5 4 3 4 6 5 5 6 6 5 4 6 6 5 4 3 5 5 4 3 2 4 4 3 2 3 4 5 6 5 4 6 6 5 4 3 5 5 4 3 2 4 4 3 2 1

5.1.1.3.   Convert image into Histogram Projection of X-axis:

Call constructor of HistogramX class which fill with number notation file name this file name is gambar-latih

```java
turunkan = new HistogramX("gambar-latih");
```

The class HistogramX is in next page.

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HistogramX.java :

```
        Histogram {

            void bubblesort(int[] numarray) {

    int n = numArray.length;
    int temp;

        (int i ; i < n; i ) {
            (int j ; j ; (n  1); j  ) {

                (numArray[j   ]   numArray[j]) {
                    temp   numArray[j   1];
                    numArray[j   ]   numArray[j];
                    numArray[j]   temp;
                }
            }
        }
    }

        String name;

    Histogram(String nm){
    name   String(nm);
    }
    File file;
    BufferedImage img;
    int i ;
    int[][] data ,data;
    int[] temp;
    int swap ;

    {

        File a   File(name   ".png");
        img   ImageIO.read(a);
        System.out.println("HistogramX.java :   "   getName());
        int xmin   img.getMinX();
        int ymin   img.getMinY();

        int ymax   ymin   img.getHeight();
        int xmax   xmin   img.getWidth();

        data    int[xmax][ymax];
        temp     int[ ];

        (int i   ; i < xmax; i  )
        {
            (int j   ; j < ymax; j  )
            {
                Color c    Color(img.getRGB(i, j));

                int red    (int)(c.getRed()      );
                int green  (int)(c.getGreen()      );
                int blue   (int)(c.getBlue()      );
                int rgb red green blue;

                (rgb   ) {

                    data [i][j]  ;

                }
                {

                    data [i][j]  ;
                }
            }bubblesort(data [i]);

        }

        System.out.println();
        (int i   ; i < xmax; i  ) {
        (int j   ; j < ymax; j  ) {

            (data [i][j]   ){

                Color c    Color(img.getRGB(i, j));
                int red    (int)(c.getRed()      );
                int green  (int)(c.getGreen()      );
                int blue   (int)(c.getBlue()      );
                int rgb red green blue;
                Color newColors    Color(r,r,r);
                img.setRGB(i,j,newColors.getRGB());
            }   {
                Color newColors    Color(          );
                img.setRGB(i,j,newColors.getRGB());
            }
        }
    }

    File output    File("Histograms.png");
    ImageIO.write(img, "png", output);
    }
    (Exception  ){}
    }
}
```

The HistogramX.java is working with reading the black pixel and white pixel. The black pixel is valued 1 and white pixel is valued 0 that store into matrix. Then, the black pixel is sorted in every row so the value of pixel is example : 111111111111100000000000000 not 10101010101010101111110001 so the pixel is piled in bottom. Then, the value is drawed in image, the image is below:

Image of Histogram Projection of X-axis:

J■ ■ J■ J■ J ■ J J ■ J■ J■ J■ J ■ ■ ■ ■ ■ ■ ■ J ■ ■ ■ J ■ ■ ■ J ■ ■ J J ■ ■ ■ J ■ ■ ■ J J ■ ■ ■ J■ ■ ■ J ■ ■ J ■ ■ ■ J ■ ■ ■ J ■ ■ J J ■ ■ J

5.1.1.4.   Reading the image of Histogram Pojection of X-axis then, store into matrix the matrix is named data[][]

```
        int xmin    img getMinX();
        int ymin    img getMinY();

        int ymax    xmin   img getHeight();
        int xmax    ymin   img getWidth();

data         int[xmax][ymax];

int xy xmax ymax;

temp         int[xmax];

    (int i    ;i xmax;i  )
    {
        (int j    ;j ymax;j  )
    {

    Color c       Color(img getRGB(i, j));

    int red    (int)(c getRed()    0.299);
    int green  (int)(c getGreen()   0.587);
    int blue   (int)(c getBlue()    0.114);
    int rgb red green-blue;

        (rgb    )  {

        data[i][j]  ;

    }
        {

        data[i][j]  ;
    }
    }
    }
```

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5.1.1.5.   Reading the matrix which is filled with value 1 and 0.

the coding of program in next page

```java
int count1=0; int count2=0; int count3=0; startaliran=0; jumfitur=0;


for(int x=0;x<img.getWidth();x++)
{
    for(int y=ymax+1;y<ymax;y++)
    {
        if(data[x][y]==1){
            width=width+1;

            if(width==0 && data[x+1][y]==0){

                if(width){
                    ...1

                    player.play("1.wav");
                    ...;
                    ...

                    ;
                    ...
                    System.out.println("no, case 3 | width = "+width+" | @["+x+"],["+y+"]        ("+"\n");

                    xstart=x-width+1;
                    tempgambar3 = img.getSubimage(xstart, 0, width, ymax);
                    player.play("1.wav");
                    System.out.println("bunyi Do");
                    System.out.println("Splitting done                              |");
                    xstart=0;
                    count3=count3+1;
                    System.out.println();
                    ...;

                    ...;
                    ...;
                    xstart=x-width+1;
                    FunctionFitur fitur =   FunctionFitur();
                    System.out.println("case 5 | width = "+width+" | @["+x+"],["+y+"]        (\n");
                    System.out.println("image Size ["+width+" x "+ymax+"]                      (\n");
                    tempgambar1 = img.getSubimage(xstart, 0, width, ymax);
                    temporary = tempgambar1;
                    tempgambar1 = null;
                    xstart=0;
                }
                count1=count1+1;
                data1=fitur.isiDataMatrix(temporary);
                System.out.println("   ");
                System.out.print("data = ");
                for(int i = 0 ; i<data1.length;i++){
                    System.out.print(data1[i]+" ");
                    jumfitur=jumfitur+data1[i];
                }
                System.out.print("   = jumfitur = "+jumfitur+"  ");
                if(jumfitur   ==5){
                    System.out.println("bunyi not so! 5.wav");
                    player.play("5.wav");
                }else if(jumfitur   ==6){
                    System.out.println("bunyi not la 6.wav");
                    player.play("6.wav");
                }else if(jumfitur   ==7){
                    System.out.println("bunyi not ti 7.wav");
                    player.play("7.wav");
                }else if(jumfitur   ==8){

                    try{
                        File database = new File("C:\Users\Deni\Documents\NetBeansProjects\AngkaSatu\src\img\\2.png");

                        gambarDatabase1 = ImageIO.read(database);
                        fiturDatabase1 = FunctionFitur.isiDataMatrixDatabase(gambarDatabase1);

                        boolean compare = true;
                        compare = ArrayCompare(data1,fiturDatabase1);
                        System.out.println("compare = "+compare);
                        if(compare == true){
                            System.out.println("play not re");
                            player.play("2.wav");
                        }
                        else{
                            System.out.println("play not mi");
                            player.play("3.wav");
                        }
                    }catch(Exception png){System.out.println("Failed To Compare re and mi");}

                }

                temporary = null;
                gambarDatabase1 = null;
                gambarDatabase2 = null;
                fiturDatabase1 = null;
                data1 = null;
                jumfitur=0;
                ...;
```

That coding is Reading the matrix value starts from the bottom of image. If the pixel is black in matrix the value is 1 until finding pixel white in matrix the value is 0 then, width is increased then, enter into the switch case as wide as the image width. Example the value of width is 3 then, enter to Switch with Case is 3 then, counting the pixel from the bottom of image to crop the image histogram projection of X-axis from number notation by width and height. It cropping start from coordinate x − value of width + 1 then, call class AudioFilePlayer to play 1.wav. It play number notation of Do.

```
public AudioFilePlayer player;
player = new AudioFilePlayer();

xstart=x-width+1;
tempgambar3 = img.getSubimage(xstart, 0, width, ymax);
player.play("1.wav");
```

For number notation of Fa is enter to switch with Case is 6 because the width of number notation of Fa is 6. Then, play 4.wav.

For number notation of Re, Mi, Sol, La, and Si is enter to Switch with Case is 5 because the width of number notation is 5. Then, it's using Image Feature and count total value image feature. The total Image Feature of number notation Sol is 34, number notation La is 36, the number notation of Si is 22. It calls the Functionfitur class. Image in below is declare fitur as object of class FunctionFitur.

```
FunctionFitur fitur= new FunctionFitur();
```

```
data1=fitur.isiDataMatrix(temporary);
```

data1 is matrix which fill with BufferedImage temporary. Temporary is made from the image number notation that has been cropped in each number. The Fucntion in next page

```
System.out.print("FiturX : ");
(int x =;x xmax;x ){
    (int y =;y ymax;y )[

        temporary2 tempx[x][y];
        temporary temporary  temporary2;
    }
    a[x] temporary;
    System out print(a[x] " ");
    temporary 0;
    k k-1;
}
k =;
System out println();

System out print("Fitury : ");
(int y =;y ymax;y )[
    (int x =;x xmax;x )[
        temporary2 tempx[x][y];
        temporary temporary  temporary2;
    }
    b[y] temporary;
        System out print(b[y] " ");
        temporary ;
}

System out println();
    (int x =;x xmax;x )[
        totalfitur[x] a[x];
}
    (int x =;x ymax;x )[
        totalfitur[xmax x] b[x];
}
System out println("total fitur : ");
    (int x =;x xy;x )[
        (x  xmax){
            System out print(totalfitur[x] " ");
        }  {
            System out print(totalfitur[x] " ");
        }
}

    totalfitur;
)
```

It Reading the matrix then, counting the total of black pixel in each row and column.

After Fill matrix data1 with Image Feature in then, counting total Image Feature become one value. if value is 34 then, call AudioFilePlayer class to play 5.wav that sound of Sol. if value is 36 then, call AudioFilePlayer class to play 6.wav that sound of La. if value is 22 then, call AudioFilePlayer class to play 7.wav that sound of Si. The number notation of Re and Mi is has same total Image Feature value, the value is 28 to handle the situation the image of number notation of Re is saved first used as database to compare the value black pixel with number notation of Mi. If true then, play 2.wav which sound of number notation of Re else play 3.wav which sound of number notation of Mi.

5.1.2. Implementation of Number Handwriting Reader

This applications using four steps that must done. For the first step you must draw numbers which start from 1 until 7 using mouse like painting. To draw the number is in below :

```
Graphics2D g2d = bImage.createGraphics();
g2d.setBackground(Color.white);
g2d.clearRect(0, 0, BI_WIDTH, BI_HEIGHT);
g2d.dispose();

Graphics2D g3d = histogramX.createGraphics();
g3d.setBackground(Color.white);
g3d.clearRect(0, 0, BI_WIDTH, BI_HEIGHT);
g3d.dispose();

Graphics2D g34d = histogramY.createGraphics();
g34d.setBackground(Color.white);
g34d.clearRect(0, 0, BI_WIDTH, BI_HEIGHT);
g34d.dispose();
```

Make 3 Blank Rectangle which used for draw the number

For the second step the image number is Projecting to Histogram Projection of X-axis. It using function HistoX function :

```
        void bubbleSort(int[] numArray) {
    int n = numArray.length;
    int temp = 0;

        for(int i = 0; i < n; i++) {
            for(int j = 1; j < (n - i); j++) {

                if(numArray[j - 1] > numArray[j]) {
                    temp = numArray[j - 1];
                    numArray[j - 1] = numArray[j];
                    numArray[j] = temp;
                }

            }
        }
}


        BufferedImage HistoX(BufferedImage src){
File file;
BufferedImage img, src;
int i,j;
int[][] dataX,data;
int[] temp;
int swap;


        int imin = img.getMinX();
        int jmin = img.getMinY();

        int ymax = ymin = img.getHeight();
        int xmax = xmin = img.getWidth();

dataX = int[xmax][ymax];
temp = int[x];

    for(int i = 0; i < xmax; i++)
    {
        for(int j = 0; j < ymax; j++ )
        {

            Color c = new Color(img.getRGB(i, j));

            int red = (int)(c.getRed());
            int green = (int)(c.getGreen());
            int blue = (int)(c.getBlue());
            int rgb = red green blue;

            if(rgb > 0) {

                dataX[i][j] = 1;
            }
            else
            {

                data[i][j] = 0;
            }

        }
        bubbleSort(dataX[i]);

    }

System.out.println();
    for(int i = 0; i < xmax; i++) {
    for(int j = 0; j < ymax; j++ ) {


        if(dataX[i][j] == 1){

            Color d = new Color(img.getRGB(i, j));
            int red = (int)(d.getRed());
            int green = (int)(d.getGreen());
            int blue = (int)(d.getBlue());
            int rgb = red green blue;
            Color newColors = new Color();
            img.setRGB(i,j,newColors.getRGB());
        } {
            Color newColors = new Color();
            img.setRGB(i,j,newColors.getRGB());
        }
    }
    }
        img;
}
```

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For the third step the image number is Projecting to Histogram Projection of Y-axis.

```
                void bubbleSort(int[] numArray) {
    int n = numArray length;
    int temp = 0;

       (int i = 0; i < n; i++) {
          (int j = 0; j < (n-1); j++) {

             (numArray[j+1] < numArray[j]) {
                temp = numArray[j+1];
                numArray[j+1] = numArray[j];
                numArray[j] = temp;
             }

          }
       }
}

             DifferentImage histog(DifferentImage img) {
    int i;
    int[][] dataX,data;
    int[] temp;
    int swap;


       int xmin = img getMinX();
       int ymin = img getMinY();

       int ymax = ymin + img getHeight();
       int xmax = xmin + img getWidth();
       ymax xmax;
       dataX    int[ymax][xmax];
       temp     int[xx];

       (int i = 0; i < ymax; i++)
       {
          (int j = 0; j < xmax; j++)
          {

             Color c = Color(img getRGB(j, i));

             int red   = (int)(c getRed()   *0.29);
             int green = (int)(c getGreen() *0.58);
             int blue  = (int)(c getBlue()  *0.11);
             int rgb red green blue;


             int red   = (int)(c getRed()   *0.29);
             int green = (int)(c getGreen() *0.58);
             int blue  = (int)(c getBlue()  *0.11);
             int rgb red green blue;

                (rgb    ) {

                dataX[i][j] ;
                }
                {

                dataX[i][j] ;
                }
          }bubbleSort(dataX[i]);

       }
       (int i = 0; i < ymax; i++) {
       (int j = 0; j < ymax; j++) {
          (dataX[i][j]  ){
             Color newColors       Color(0,0,0);
             img setRGB(j,i,newColors getRGB());
          }  {
             Color newColors       Color(255,255,255);
             img setRGB(j,i,newColors getRGB());
          }
       }
    }
       img;
}
```

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For the fourth step is reading the image of projection Histogram of Y-axis. Then, Implementing PCINNS algorithm to convert image become sound. The algorithm has been explained in Literature study and the code of program is too long so it not be included in here.

5.2 Testing

5.1.3.   Testing Convert Image Number Notation to Sound

Convert Image Number Notation to Sound will read number in image and convert to sound become a song. The each number notation has value total Image Feature and width differently.

5.2.1 Table Testing

Number Notation	Width	Value Total Image Feature
1	3	
2	5	28
3	5	28
4	6	
5	5	34
6	5	36
7	5	22

The value total Image Feature of number notation 1 and 4 is blank because in this program is not counted because both of width is very different with each other.

5.1.4. Testing Number Handwriting Reader

Number Handwriting Reader will read the number handwriting that write in place that provided.
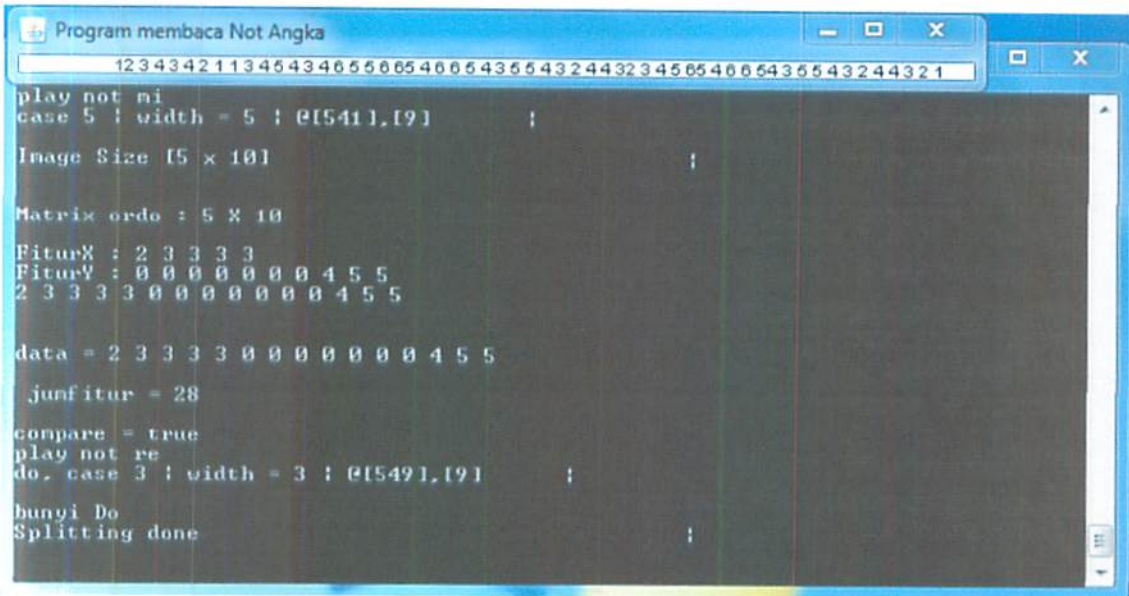
5.2.2 Table Testing

Number Notation	Characteristic to String	Range value Image Feature Part 1	Range value Image Feature Part 2	Range value Image Feature Part 3
1		$20-27 \parallel 10-20$		
2	Snout-flat-snout	$30-65$	$20-30$	$30-75$
3	Snout-snout-snout	$25-65$	$30-65$	$28-65$
4	Snout-snout-flat	$25-65$	$50-80$	$15-22$
5	Snout-snout-snout-mount	$30-65$	$15-20$	$40-65$
6	Snout-snout-snout-mount	$20-25$	$20-25$	$25-45$
7		$40-50 \parallel 10-30$		

5.2. Main Interface Window

5.2.1. Main Interface Window of Convert Image Number Notation to Sound:

This is main interface of convert image number notation to sound only show the numbers notation to convert and play as song. The number is derived from string which draw to image with font as arial with height is 10. It inputed from coding side.

Figure 5.3.1 Main Interface of Convert Image Number Notation to Sound

5.2.2.   Main Interface Window of Number Handwriting Reader

This is the main interface of Number Handwriting Reader. It will do 3 process :

1. Drawing image using mouse as brush.

2. Clear image.

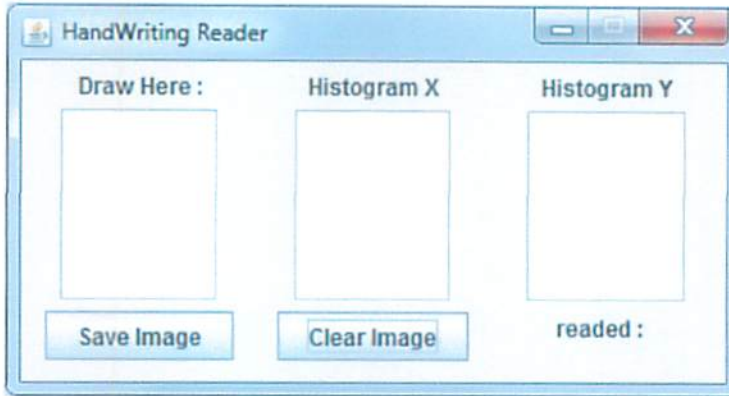3. If needed it can save the image which has been drawn.

Figure 5.3.2.1 The main Interface of Number Handwriting Reader

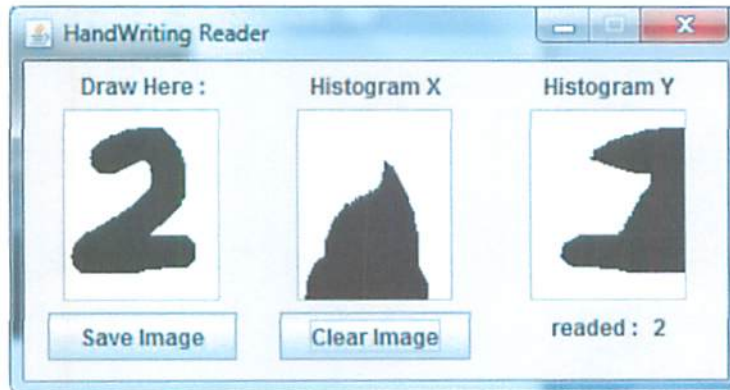If we draw number 2 in that space which provided then, will be show like below :

Figure 5.3.2.2 The Number Handwriting Reader After Drawing

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The application read number two then, play sound of number notation Re. 2.wav. If the application cannot recognize the drawn image number it will show like below:

Figure 5.3.2.3 The program cannot recognize the input image