

## CHAPTER V IMPLEMENTATION AND TESTING

### 5.1 Implementation

The watermarking simulation consists of these steps :

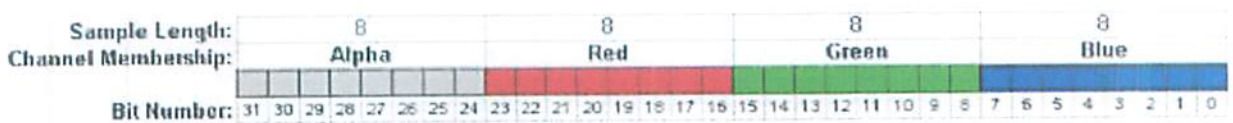
#### 5.1.1 Encryption

Encryption or embedding step is to hide the message in image. First, make an empty byte array. Fill the array with the bytes from the converted text. Then the byte is converted to binary as String.

```
byte[] bytes = null;
bytes = teks.getBytes("UTF-8");//char to byte
for (byte b : bytes) {foreach
String bin = Integer.toBinaryString(b);//byte to binary
System.out.println(bin);//print binary
```

*Figure 5.1 Char to byte*

Then image is converted to byte array. In this case, only get the red value. The red value is located in 16<sup>th</sup> to 23<sup>rd</sup> byte in pixel. Thus, convert the RGB value with Blue as the starting point.



*Figure 5.2 RGB channel visualization*

```

public static String getImageData(int pixel) {
    String pixelARGBData = "";
    //int alpha = (pixel >> 24) & 0x000000FF;
    int red = (pixel >> 16) & 0x000000FF;
    //int green = (pixel >> 8 ) & 0x000000FF;
    //int blue = (pixel) & 0x000000FF;
    pixelARGBData = "R : " + red;
}

```

*Figure 5.3 RGB conversion*

```

public static void printImageData(BufferedImage image) throws IOException{
    int width = image.getWidth();
    int height = image.getHeight();
    int wh = width*height;
    String[] gambar=new String[wh]; //jumlah px gambar
    System.out.println("Image Dimension: Height-" + height + ", Width-" + width);
    System.out.println("Total Pixels: " + (height * width));

    for (int i = 0; i < width; i++) {
        for (int j = 0; j < height; j++) {
            int pixel = image.getRGB(i, j);
            System.out.println("\n Pixel Location(" + i + ", " + j + ") - [" + getImageData(pixel) + "]);
            gambar[(i*width)+j]=getImageData(pixel);
        }
    }
}

```

*Figure 5.4 Print image data*

After getting the red value, count the image pixels amount. To measure the width and height, use `getWidth()` and `getHeight()`. Because image is a two dimensional array, to get the total pixels, multiply the width and the height.

Then get the pixel location. Make two dimensional array from the image width and height then print the location based on the array.

Because the text array and the image array are different, the text array is in one dimensional form and the image array is in two dimensional form, to place the text bits in the image last bit location, the image array need to be converted to one dimensional array.

## 5.1.2 Decryption

```
System.out.println("\nDECRYPT\n");
String kar = "";
for(int w = 0; w < len*8; w++){
    kar+=gambar[w].substring(7,8);//ambil last bit dari image
}
System.out.println("kar " + kar);//print last bit
String str="";
for (int i = 0; i < kar.length()/8; i++) { //potong jadi per 8
    int a = Integer.parseInt(kar.substring(i*8,(i+1)*8),2); //return as integer, ubah jadi desimal
    str += (char) (a);
}
System.out.println("str " +str);//print karakter
}
```

*Figure 5.5 Decryption process*

To decrypt, make new empty String to hold the result of decryption. Loop through watermarked image's pixel and get the Red value last bit. Then, cut the result every 8 bits, return the result as Integer, and convert the bits to character.

## 5.2 Testing

```
root@fany-pc: /home/fany/Desktop/file
root@fany-pc: /home/fany/Desktop/file# javac Watermark.java
root@fany-pc: /home/fany/Desktop/file# java Watermark
110001
char:a -> 01100001
110010
char:b -> 01100010
110011
char:c -> 01100011

011000010110001001100011
Image Dimension: Height-5, Width-5
Total Pixels: 25
Pixel Location(0,0) - [11111111]
Pixel Location(0,1) - [11111111]
Pixel Location(0,2) - [11111111]
Pixel Location(0,3) - [11111111]
Pixel Location(0,4) - [11111111]
Pixel Location(1,0) - [11111111]
Pixel Location(1,1) - [00000000]
Pixel Location(1,2) - [00000000]
Pixel Location(1,3) - [00000000]
Pixel Location(1,4) - [11111111]
Pixel Location(2,0) - [11111111]
Pixel Location(2,1) - [00000000]
Pixel Location(2,2) - [00000000]
Pixel Location(2,3) - [00000000]
Pixel Location(2,4) - [11111111]
Pixel Location(3,0) - [11111111]
Pixel Location(3,1) - [00000000]
Pixel Location(3,2) - [00000000]
Pixel Location(3,3) - [00000000]
```

*Figure 5.6 Character conversion*

First, the display shows the text is converted to binary. Then the text binary is padded to 8 bits binary. To ease the process of encryption, the text binary is collected in an array of string.

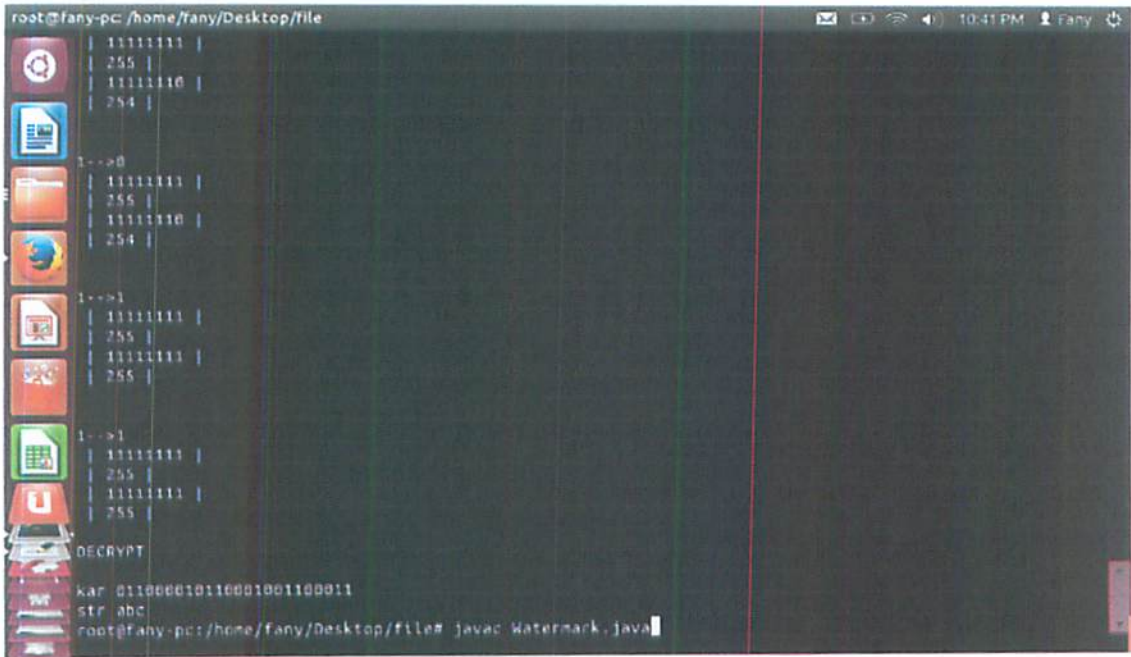
Second, check the size of the image to determined if the image can holds the message.

```
root@fany-pc: /home/fany/Desktop/file
Pixel Location(4,4) - [11111111]
Pixel Location(4,0) - [11111111]
Pixel Location(4,1) - [11111111]
Pixel Location(4,2) - [11111111]
Pixel Location(4,3) - [11111111]
Pixel Location(4,4) - [11111111]
ENCRYPT
1-->0
| 11111111 |
| 255 |
| 11111110 |
| 254 |
1-->1
| 11111111 |
| 255 |
| 11111111 |
| 255 |
1-->1
| 11111111 |
| 255 |
| 11111111 |
| 255 |
```

*Figure 5.7 Decryption detail*

The encryption process shows that the original image last bit is replaced by text binary and the pixel value is changed 1 bit.























*Figure 5.8 Decryption result*

The decryption process shows the last bit of encrypted image is extracted to an array of string and then is converted to ASCII characters.

*Table 5.1 Encryption Table*

Image	Size (pixels)	Maximum message length (characters)	Encryption message	Watermarked Image
	5x5	3	abc	
	16x16	32	ini adalah pesan rahasia FACEBOOK	

	20x20	50	Pesan rahasia instagram hingga lima puluh karakter	
	32x32	128	Statistik tentang survei jumlah penggunaan internet : 20% untuk tugas, 30% untuk games, 50% untuk film/musik/buku/dll	
	50x20	125	Jika anda menerima pesan ini segera beritahukan bahwa kita akan menyerang negara tersebut dalam waktu yang secepat-cepatnya!	
	50x50	312	Online business schools enable Programme Graduates to start their professional career abroad. In fact, multiple exchange agreements in many countries place online business schools among the World's most successful. The schools also develop and expand their networks constantly with MBA. This is just test for you	
	50x75	468	The cultural mix is commonplace in the business school, with more than one in three students being from overseas. Professors and researchers from partner universities also participate in teaching, research and seminars. Visiting students of all nationalities, foreign professors stakeholders,	

			study visits, internships abroad, international conferences, online business schools apply internationalization to the heart of student life. This is the end of message series	
	60x60	450	A Facebook status is another area that has a character limit as well. The limit for the status has been raised to 63,206 characters. Previously, it was 5,000 but it has been raised 12 times to accommodate user's status or feedback. For Facebook wall posts, it has a 5000 character limit. So if you wish to write on someone else wall, you can even write a blog. When you see this message please take out the second letter of every sentence then check!	
	100x20	250	"Another summer day has come and gone away in Paris and Rome but I wanna go home. May be surrounded by million people I still feel all alone. I just wanna go home. Oh, I miss you, you know. And I've been keeping all the letters. That I wrote to you."	
























	256x256	8192	Unika Soegijapranata...	
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Table 5.2 Decryption Table

Watermarked Image	Decryption	Decrypted Image
	abc	
	ini adalah pesan rahasia FACEBOOK	
	Pesan rahasia instagram hingga lima puluh karakter	
	Statistik tentang survei jumlah penggunaan internet : 20% untuk tugas, 30% untuk games, 50% untuk film/musik/buku/dll	
	Jika anda menerima pesan ini segera beritahukan bahwa kita akan menyerang negara tersebut dalam waktu yang secepat- cepatnya!	
	Online business schools enable Programme Graduates to start their professional career abroad. In fact, multiple exchange agreements in many	

	<p>countries place online business schools among the World's most successful. The schools also develop and expand their networks constantly with MBA. This is just test for you</p>	
 <p>A small icon of a wolf's head in profile, facing right, with the word "WOLF" written in white capital letters above it. The icon is set against a green rectangular background.</p>	<p>The cultural mix is commonplace in the business school, with more than one in three students being from overseas. Professors and researchers from partner universities also participate in teaching, research and seminars. Visiting students of all nationalities, foreign professors stakeholders, study visits, internships abroad, international conferences, online business schools apply internationalization to the heart of student life. This is the end of message series</p>	 <p>A small icon of a wolf's head in profile, facing right, with the word "WOLF" written in white capital letters above it. The icon is set against a green rectangular background.</p>
 <p>A colorful emoji of a smiling face with flames coming out of its mouth, set against a black square background.</p>	<p>A Facebook status is another area that has a character limit as well. The limit for the status has been raised to 63,206 characters. Previously, it was 5,000 but it has been raised 12 times to accommodate user's status or feedback. For Facebook wall posts, it has a 5000 character limit. So if you wish to write on</p>	 <p>A colorful emoji of a smiling face with flames coming out of its mouth, set against a black square background.</p>

	<p>someone else wall, you can even write a blog. When you see this message please take out the second letter of every sentence then check!</p>	
	<p>"Another summer day has come and gone away in Paris and Rome but I wanna go home. May be surrounded by million people I still feel all alone. I just wanna go home. Oh, I miss you, you know. And I've been keeping all the letters. That I wrote to you."</p>	
	<p>Unika Soegijapranata...</p>	