

# Praktikum 6

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## Enhancement Citra (2)

### Histogram Equalisasi

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#### POKOK BAHASAN :

- ✓ Histogram
- ✓ Histogram Equalisasi

#### TUJUAN BELAJAR :

Setelah melakukan praktikum pada bab ini, mahasiswa diharapkan mampu:

- ✓ Membuat program menampilkan histogram citra gray scale
- ✓ Membuat program menampilkan histogram citra setelah pengaturan brightness
- ✓ Membuat program menampilkan histogram citra setelah pengaturan contrast
- ✓ Membuat program enhancement citra dengan histogram equalisasi

#### DASAR TEORI :

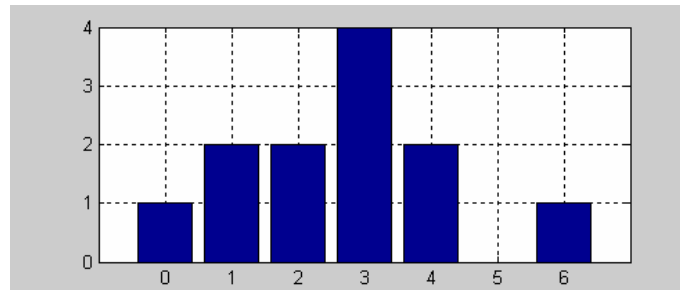
##### **Histogram Equalization**

Histogram Equalization adalah suatu proses perataan histogram, dimana distribusi nilai derajat keabuan pada suatu citra dibuat rata. Untuk dapat melakukan histogram equalization ini diperlukan suatu fungsi distribusi kumulatif yang merupakan kumulatif dari histogram.

Misalkan diketahui data sebagai berikut:

2 4 3 1 3 6 4 3 1 0 3 2

Maka histogram dari data di atas adalah:

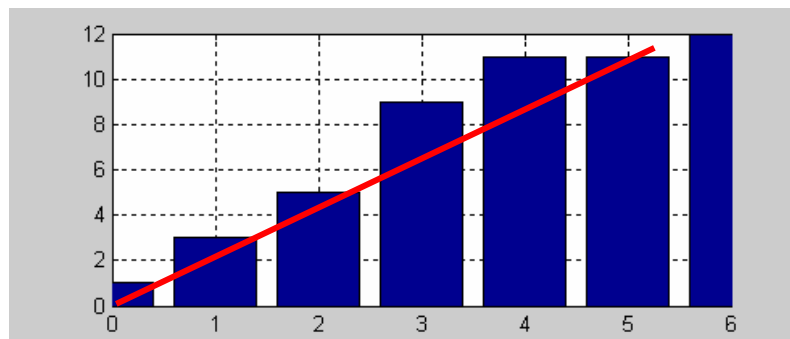


Gambar 6.1 Contoh histogram

Proses perhitungan distribusi kumulatif dapat dijelaskan dengan tabel berikut:

Nilai	Histogram	Distribusi kumulatif
0	1	1
1	2	$1+2=3$
2	2	$3+2=5$
3	4	$5+4=9$
4	2	$9+2=11$
5	0	$11+0=11$
6	1	$11+1=12$

Dan diperoleh histogram kumulatif sebagai berikut:



Gambar 6.2 Histogram kumulatif

Histogram equalization (perataan histogram) adalah suatu proses dimana histogram diratakan berdasarkan suatu fungsi linier (garis lurus) seperti terlihat pada gambar 6.2.

Teknik perataan histogram adalah sebagai berikut:

Nilai asal	Histogram Kumulatif	Nilai hasil
0	1	$\frac{1}{2} \rightarrow 0$
1	3	$\frac{3}{2} \rightarrow 1$
2	5	$\frac{5}{2} \rightarrow 2$
3	9	$\frac{9}{2} \rightarrow 4$
4	11	$\frac{11}{2} \rightarrow 5$
5	11	$\frac{11}{2} \rightarrow 5$
6	12	$\frac{12}{2} \rightarrow 6$

Nilai hasil histogram equalization adalah sebagai berikut:

$$w = \frac{c_w \cdot th}{n_x \cdot n_y}$$

dimana

$w$  = nilai keabuan hasil histogram equalization

$c_w$  = histogram kumulatif dari  $w$

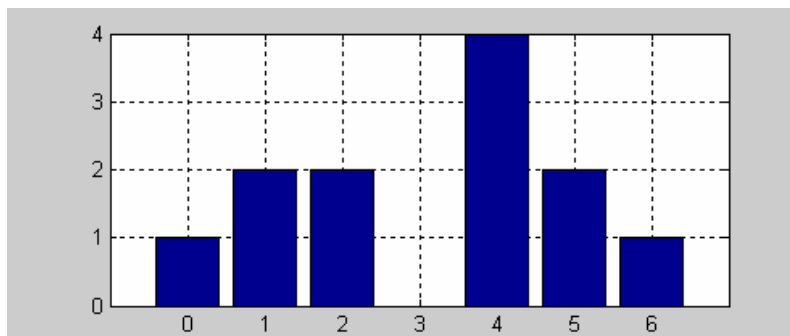
$th$  = threshold derajat keabuan (256)

$n_x$  dan  $n_y$  = ukuran gambar

Hasil setelah histogram equalization adalah sebagai berikut:

2 5 4 1 4 6 5 4 1 0 4 2

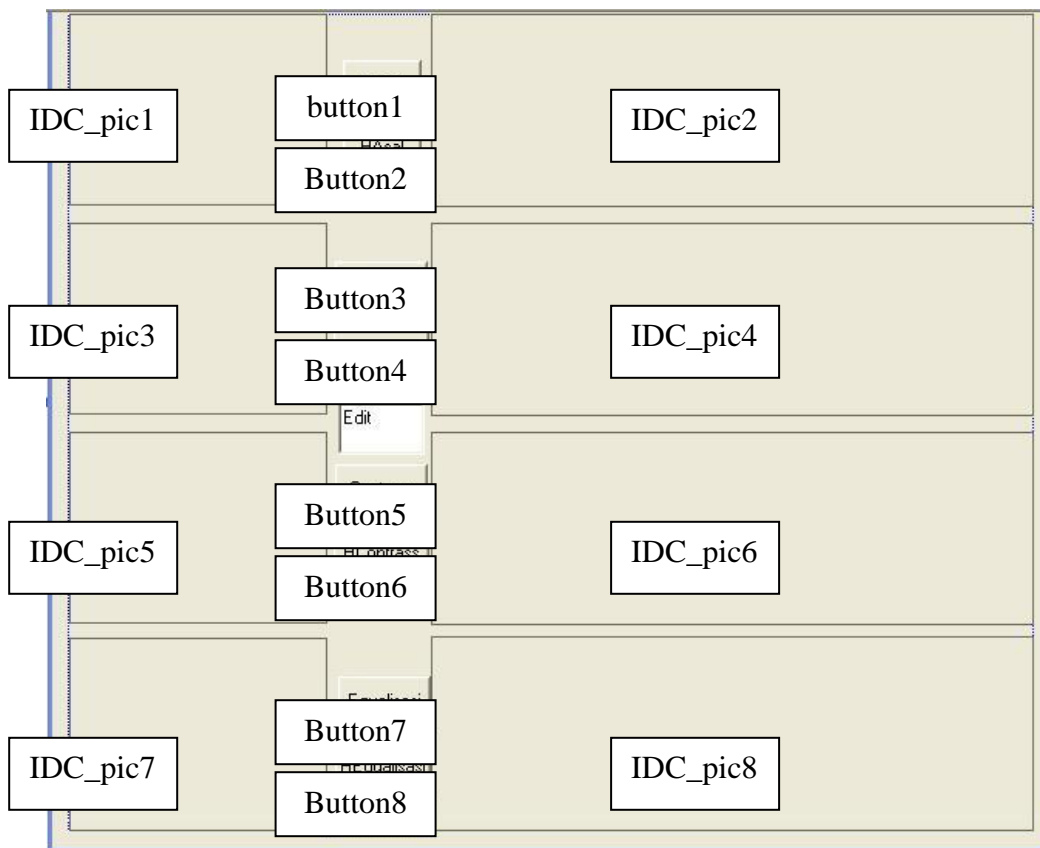
Histogram dari hasil histogram equalization:



Gambar 6.3 Histogram dari hasil histogram equalization

## PERCOBAAN :

1. Buatlah disain gui seperti gambar 6.4. (4 control picture untuk menampilkan citra asal, citra hasil perubahan brightness, citra hasil perubahan kontras, dan citra hasil histogram equalisasi, 4 control picture untuk menampilkan histogram citra asal, histogram citra hasil perubahan brightness, histogram citra hasil perubahan kontras, dan histogram citra hasil histogram equalisasi, 8 button : load citra, menampilkan histogram asal, proses brightness, histogram brightness, proses kontras, histogram kontras, proses equalisasi, histogram equalisasi, dan 1 buah edit box).



Gambar 6.4. Disain GUI

2. Rubah semua properti ID pada control picture dengan IDC\_pic1 s/d IDC\_pic8
3. Set member variabel control picture, button dan edit box seperti gambar 6.5.

Control IDs:	Type	Member
IDC_BUTTON1	CButton	m_loadqbr
IDC_BUTTON2	CButton	m_btnHAsal
IDC_BUTTON3	CButton	m_btnbrightness
IDC_BUTTON4	CButton	m_btnHBrightness
IDC_BUTTON5	CButton	m_btnContras
IDC_BUTTON6	CButton	m_btnHContrass
IDC_BUTTON7	CButton	m_btnEqualisasi
IDC_BUTTON8	CButton	m_btnHEqualisasi
IDC_EDIT1	CEdit	m_txtEdit1
IDC_pic1	CStatic	m_pic1
IDC_pic2	CStatic	m_pic2
IDC_pic3	CStatic	m_pic3
IDC_pic4	CStatic	m_pic4
IDC_pic5	CStatic	m_pic5
IDC_pic6	CStatic	m_pic6
IDC_pic7	CStatic	m_pic7
IDC_pic8	CStatic	m_pic8

Gambar 6.5. Member Variabel

4. Tambahkan pada header file xxxdlg.h : CBitmap m\_bmpBitmap;
5. Tambahkan prosedur pada file xxxdlg.cpp :

```
void WarnaToRGB(long int warna,int *Red, int *Green,
int *Blue)
{
    *Red = warna & 0x000000FF;
    *Green = (warna & 0x0000FF00) >> 8;
    *Blue = (warna & 0x00FF0000) >> 16;
}
long int RGBToWarna(int Red, int Green, int Blue)
{
    return(Red+(Green<<8)+(Blue<<16));
}
```

6. Siapkan gambar bmp pada directory project C “test2.bmp” :



7. Klik 2x button Load ketikkan program berikut pada :

```
void CxxxDlg::OnButton1()
{
    // TODO: Add your control notification handler
    //code here
    int i,j,red,green,blue,gray;
    long int warna,warnagray;
    CDC* pDC = m_pic1.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
```

```

HBITMAP
hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
"test2.bmp",IMAGE_BITMAP, 0, 0,
LR_LOADFROMFILE|LR_CREATEDIBSECTION);
    if(hBitmap)
    {
        if(m_bmpBitmap.DeleteObject())
            m_bmpBitmap.Detach();
        m_bmpBitmap.Attach(hBitmap);
    }
    m_pic1.GetClientRect(rect);
    m_bmpBitmap.GetBitmap(&bm);
    dcMem1.CreateCompatibleDC(pDC);
    dcMem1.SelectObject(&m_bmpBitmap);
    for(i=0;i<bm.bmHeight;i++)
    for(j=0;j<bm.bmWidth;j++)
    {
        warna=dcMem1.GetPixel(j,i);
        WarnaToRGB(warna,&red,&green,&blue);
        gray=int(red+green+blue)/3;
        warnagray=RGBToWarna(gray,gray,gray);
        dcMem1.SetPixel(j,i,warnagray);
    }
    pDC->StretchBlt(0,0,rect.Width(),rect.Height(),&dcMem1,0,0,
    ,bm.bmWidth,bm.bmHeight,SRCCOPY);
}

```

8. Klik 2x button brightness ketikkan program berikut pada :

```

void CxxxDlg::OnButton3()
{
    int i,j,red,green,blue,gray;
    long int warna,warnagray;
    CDC* pDC = m_pic3.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    HBITMAP
hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
"test2.bmp",IMAGE_BITMAP, 0, 0,
LR_LOADFROMFILE|LR_CREATEDIBSECTION);
    if(hBitmap)
    {
        if(m_bmpBitmap.DeleteObject())
            m_bmpBitmap.Detach();
        m_bmpBitmap.Attach(hBitmap);
    }
}

```

```

m_pic3.GetClientRect(rect);
m_bmpBitmap.GetBitmap(&bm);
dcMem1.CreateCompatibleDC(pDC);
dcMem1.SelectObject(&m_bmpBitmap);
int k=GetDlgItemInt(IDC_EDIT1);
for(i=0;i<bm.bmHeight;i++)
for(j=0;j<bm.bmWidth;j++)
{
    warna=dcMem1.GetPixel(j,i);
    WarnaToRGB(warna,&red,&green,&blue);
    gray=int(red+green+blue)/3;
    gray=gray+k;
    if(gray>255)gray=255;
    if(gray<0)gray=0;
    warnagray=RGBToWarna(gray,gray,gray);
    dcMem1.SetPixel(j,i,warnagray);
}
pDC-
>StretchBlt(0,0,rect.Width(),rect.Height(),&dcMem1,0,0
,bm.bmWidth,bm.bmHeight,SRCCOPY);
}

```

9. Uji Coba dengan memasukkan nilai 20, 30, 60 , -10, -20 ,-30 pada edit box kemudian amati perubahan hasilnya dibandingkan citra asal.
10. Klik 2x button kontras ketikkan program berikut pada :

```

void CPrakHistogram3ITADlg::OnButton5()
{
    int i,j,red,green,blue,gray;
    long int warna,warnagray;
    CDC* pDC = m_pic5.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    HBITMAP
    hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
    "test2.bmp",IMAGE_BITMAP, 0, 0,
    LR_LOADFROMFILE|LR_CREATEDIBSECTION);
    if(hBitmap)
    {
        if(m_bmpBitmap.DeleteObject())
            m_bmpBitmap.Detach();
        m_bmpBitmap.Attach(hBitmap);
    }
}

```

```

m_pic5.GetClientRect(rect);
m_bmpBitmap.GetBitmap(&bm);
dcMem1.CreateCompatibleDC(pDC);
dcMem1.SelectObject(&m_bmpBitmap);
int k=GetDlgItemInt(IDC_EDIT1);
float fk=k/100.;
for(i=0;i<bm.bmHeight;i++)
for(j=0;j<bm.bmWidth;j++)
{
    warna=dcMem1.GetPixel(j,i);
    WarnaToRGB(warna,&red,&green,&blue);
    gray=int(red+green+blue)/3;
gray=int(gray*fk);
    if(gray>255)gray=255;
    warnagray=RGBToWarna(gray,gray,gray);
    dcMem1.SetPixel(j,i,warnagray);
}
pDC-
>StretchBlt(0,0,rect.Width(),rect.Height(),&dcMem1,0,0
,bm.bmWidth,bm.bmHeight,SRCCOPY);
}

```

11. Uji Coba dengan memasukkan nilai 5, 20, 30, 50, 60, 80 pada edit box kemudian amati perubahan hasilnya dibandingkan citra asal.
12. Klik 2x button Histogram Asal ketikkan program berikut pada :

```

void CxxxDlg::OnButton2()
{
    CDC* pDC = m_pic1.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    char str[5];
    int i,j;
    int red,green,blue,gray;
    long int warna;
    float h[256];
    HBITMAP
hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
"test2.bmp",IMAGE_BITMAP, 0, 0,
LR_LOADFROMFILE|LR_CREATEDIBSECTION);
if(hBitmap)
{
    if(m_bmpBitmap.DeleteObject())
        m_bmpBitmap.Detach();
    m_bmpBitmap.Attach(hBitmap);
}
}

```



```

m_pic1.GetClientRect(rect);
m_bmpBitmap.GetBitmap(&bm);
dcMem1.CreateCompatibleDC(pDC);
dcMem1.SelectObject(&m_bmpBitmap);
for(i=0;i<256;i++)h[i]=0;
for(i=0;i<bm.bmHeight;i++)
for(j=0;j<bm.bmWidth;j++)
{
    warna=dcMem1.GetPixel(j,i);
    WarnaToRGB(warna,&red,&green,&blue);
    gray=int(red+green+blue)/3;
    h[gray]++;
}
float hmax=h[0];
for(i=1;i<256;i++)
if(h[i]>hmax)hmax=h[i];
for(i=0;i<256;i++)
    h[i]=int(120*(h[i]/hmax));
/* menampilkan nilai histogram level 0-100
for(i=0;i<100;i++)
{sprintf(str,"%f",h[i]);
pDC->TextOut(10,i*10,str);}*/
CDC* pDC1 = m_pic2.GetDC();
pDC1->MoveTo(0,120); //Koordinat 0,0
pDC1->LineTo(400,120); //sb x
pDC1->MoveTo(0,120-(int)h[0]); //gray = 0
pDC1->LineTo(0,120); //grs ke sb x
for(i=1;i<256;i++)
{
    pDC1->MoveTo(i*2,120-(int)h[i]);
    pDC1->LineTo(i*2,120); //grs ke sb x
}
}

```

13. Klik 2x button Histogram Brightness ketikkan program berikut pada :

```

void CxxxDlg::OnButton4()
{
    CDC* pDC = m_pic3.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    char str[5];
    int i,j;
    int red,green,blue,gray;
    long int warna;
    float h[256];
    HBITMAP
hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
    "test2.bmp",IMAGE_BITMAP, 0, 0,
    LR_LOADFROMFILE|LR_CREATEDIBSECTION);

```

```

if(hBitmap)
{
    if(m_bmpBitmap.DeleteObject())
        m_bmpBitmap.Detach();
    m_bmpBitmap.Attach(hBitmap);
}
m_pic3.GetClientRect(rect);
m_bmpBitmap.GetBitmap(&bm);
dcMem1.CreateCompatibleDC(pDC);
dcMem1.SelectObject(&m_bmpBitmap);
int k=GetDlgItemInt(IDC_EDIT1);
for(i=0;i<256;i++)h[i]=0;
for(i=0;i<bm.bmHeight;i++)
for(j=0;j<bm.bmWidth;j++)
{
    warna=dcMem1.GetPixel(j,i);
    WarnaToRGB(warna,&red,&green,&blue);
    gray=int(red+green+blue)/3;
    gray=gray+k;
    if(gray>255)gray=255;
    if(gray<0)gray=0;
    h[gray]++;
}
float hmax=h[0];
for(i=1;i<256;i++)
if(h[i]>hmax)hmax=h[i];
for(i=0;i<256;i++)
/* dikalikan konstanta jika jumlah hmax >>
h[i]=int(120*(h[i]/hmax)*5);
/*sprintf(str,"%f",hmax);
pDC->TextOut(100,50,str);
for(i=100;i<256;i++)
{sprintf(str,"%f",h[i]);
pDC->TextOut(10,(100-i)*10,str);}
*/
CDC* pDC1 = m_pic4.GetDC();
pDC1->MoveTo(0,120);//Koordinat 0,0
pDC1->LineTo(400,120);//sb x
pDC1->MoveTo(0,120-(int)h[0]);//gray = 0
pDC1->LineTo(0,120);//grs ke sb x
for(i=1;i<256;i++)
{
    pDC1->MoveTo(i*2,120-(int)h[i]);
    pDC1->LineTo(i*2,120);//grs ke sb x
}
}

```

14. Klik 2x button Histogram Kontras ketikkan program berikut pada :

```
void CxxxDlg::OnButton6()
{
    CDC* pDC = m_pic5.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    char str[5];
    int i,j;
    int red,green,blue,gray;
    long int warna;
    float h[256];
    HBITMAP
    hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
    "test2.bmp",IMAGE_BITMAP, 0, 0,
    LR_LOADFROMFILE|LR_CREATEDIBSECTION);
    if(hBitmap)
    {
        if(m_bmpBitmap.DeleteObject())
            m_bmpBitmap.Detach();
        m_bmpBitmap.Attach(hBitmap);
    }
    m_pic5.GetClientRect(rect);
    m_bmpBitmap.GetBitmap(&bm);
    dcMem1.CreateCompatibleDC(pDC);
    dcMem1.SelectObject(&m_bmpBitmap);
    int k=GetDlgItemInt(IDC_EDIT1);
    float fk=k/100.;
    for(i=0;i<256;i++)h[i]=0;
    for(i=0;i<bm.bmHeight;i++)
    for(j=0;j<bm.bmWidth;j++)
    {
        warna=dcMem1.GetPixel(j,i);
        WarnaToRGB(warna,&red,&green,&blue);
        gray=int(red+green+blue)/3;
        gray=int(gray*fk);
        if(gray>255)gray=255;
        if(gray<0)gray=0;
        h[gray]++;
    }
    float hmax=h[0];
    for(i=1;i<256;i++)
    if(h[i]>hmax)hmax=h[i];
    /* dikalikan konstanta jika jumlah hmax >>
    for(i=0;i<256;i++)
        h[i]=int(120*(h[i]/hmax)*15);
    sprintf(str,"%f",hmax);
    pDC->TextOut(100,50,str);
    /*for(i=100;i<256;i++)
    {sprintf(str,"%f",h[i]);
    pDC->TextOut(10,(100-i)*10,str);}*/
```

```

CDC* pDC1 = m_pic6.GetDC();
pDC1->MoveTo(0,120); //Koordinat 0,0
pDC1->LineTo(400,120); //sb x
pDC1->MoveTo(0,120-(int)h[0]); //gray = 0
pDC1->LineTo(0,120); //grs ke sb x
for(i=1;i<256;i++)
{
    pDC1->MoveTo(i*2,120-(int)h[i]);
    pDC1->LineTo(i*2,120); //grs ke sb x
}
}

```

15. Klik 2x button Equalisasi ketikkan program berikut :

```

void CxxxDlg::OnButton7()
{
    CDC* pDC = m_pic7.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    int i,j;
    int red,green,blue,gray;
    long int warna;
    float h[256];
    HBITMAP
hBitmap=(HBITMAP)::LoadImage(AfxGetInstanceHandle(),
    "test2.bmp",IMAGE_BITMAP, 0, 0,
LR_LOADFROMFILE|LR_CREATEDIBSECTION);
    if(hBitmap)
    {
        if(m_bmpBitmap.DeleteObject())
            m_bmpBitmap.Detach();
        m_bmpBitmap.Attach(hBitmap);
    }
    m_pic7.GetClientRect(rect);
    m_bmpBitmap.GetBitmap(&bm);
    dcMem1.CreateCompatibleDC(pDC);
    dcMem1.SelectObject(&m_bmpBitmap);
    for(i=0;i<256;i++)
    h[i]=0;
    for(i=0;i<bm.bmHeight;i++)
    for(j=0;j<bm.bmWidth;j++)
    {
        warna=dcMem1.GetPixel(j,i);
        WarnaToRGB(warna,&red,&green,&blue);
        gray=int(red+green+blue)/3;
        h[gray]++;}
    float c[256];
    c[0]=h[0];
}

```

```

for(i=1;i<256;i++)
    c[i]=c[i-1]+h[i];
for(i=0;i<256;i++)
    c[i]=c[i]/bm.bmHeight/bm.bmWidth;
for(i=0;i<256;i++)h[i]=0;
for(i=0;i<bm.bmHeight;i++)
for(j=0;j<bm.bmWidth;j++)
    {warna=dcMem1.GetPixel(j,i);
WarnaToRGB(warna,&red,&green,&blue);
gray=int(red+green+blue)/3;
gray=c[gray]*255;
h[gray]++;
warna=RGBToWarna(gray,gray,gray);
dcMem1.SetPixel(j,i,warna);}
pDC-
>StretchBlt(0,0,rect.Width(),rect.Height(),&dcMem1,0,0,bm.bmWidth,
bm.bmHeight,SRCCOPY);
}

```

16. Klik 2x button Histogram Equalisasi ketikkan program berikut pada :

```

void CxxxDlg::OnButton8()
{
    CDC* pDC = m_pic7.GetDC();
    CDC dcMem1;
    CRect rect;
    BITMAP bm;
    char str[5];
    int i,j;
    int red,green,blue,gray;
    long int warna;
    float h[256];
    m_pic7.GetClientRect(rect);
    m_bmpBitmap.GetBitmap(&bm);
    dcMem1.CreateCompatibleDC(pDC);
    dcMem1.SelectObject(&m_bmpBitmap);
    for(i=0;i<256;i++)h[i]=0;
    for(i=0;i<bm.bmHeight;i++)
    for(j=0;j<bm.bmWidth;j++)
    {
        warna=dcMem1.GetPixel(j,i);
        WarnaToRGB(warna,&red,&green,&blue);
        gray=int(red+green+blue)/3;
        if(gray>255)gray=255;
        if(gray<0)gray=0;
        h[gray]++;
    }
}

```

```

        float hmax=h[0];
        for(i=1;i<256;i++)
            if(h[i]>hmax)hmax=h[i];
        for(i=0;i<256;i++)
            /* dikalikan konstanta jika jumlah hmax >>
               h[i]=int(120*(h[i]/hmax));
        /*sprintf(str,"%f",hmax);
        pDC->TextOut(100,50,str);
        for(i=100;i<256;i++)
        {sprintf(str,"%f",h[i]);
          pDC->TextOut(10,(100-i)*10,str);}*/
        CDC* pDC1 = m_pic8.GetDC();
        pDC1->MoveTo(0,120); //Koordinat 0,0
        pDC1->LineTo(400,120); //sb x
        pDC1->MoveTo(0,120-(int)h[0]); //gray = 0
        pDC1->LineTo(0,120); //grs ke sb x
        for(i=1;i<256;i++)
        {
            pDC1->MoveTo(i*2,120-(int)h[i]);
            pDC1->LineTo(i*2,120); //grs ke sb x
        }
    }
}

```

#### LAPORAN RESMI :

1. Amati hasil citra dan histogram perubahan brightness
2. Capture citra hasil dan histogram brightness
3. Buat kesimpulan berdasarkan hasil citra dan histogram perubahan brightnessnya
4. Amati hasil citra dan histogram perubahan kontras
5. Capture citra hasil dan histogram kontras
6. Buat kesimpulan berdasarkan hasil citra dan histogram perubahan kontrasnya
7. Amati hasil citra dan histogram setelah equalisasi
8. Capture citra hasil dan histogram equalisasi
9. Buat kesimpulan berdasarkan hasil citra dan histogram equalisasi