

10

OBJECT TRACKING BASED ON RGB COLOR IMAGE FILTERING USING CAMERA

Pada pokok bahasan ini, mahasiswa akan mengaplikasikan RGB color filtering untuk mendeteksi dan mentracking objek secara real time menggunakan kamera.

Pokok Bahasan :

1. Traking objek menggunakan RGB Color Filter

Latihan:

2. Membuat aplikasi tracking objek menggunakan RGB color filter secara *real time*

10.1. Aforge.Video dan Aforge.Video.DirectShow

Capaian pembelajaran: memahami dan mengaplikasikan RGB color filter untuk mentracking objek bergerak yang tercapture camera.

Pada dasarnya penggunaan Color filter pada objek bergerak sama dengan penggunaannya pada objek diam (citra). Perbedaannya hanya terletak pada input yang akan diolah. Untuk tracking objek bergerak maka input bisa berasal dari video yang sudah terekam maupun objek yang secara real time tercapture oleh kamera..

Beberapa kelas yang diberikan diantaranya

1. **FilterInfoCollection** merupakan kelas yang berisi koleksi informasi dari filter untuk mencari informasi tentang kamera
2. **VideoCaptureDevice** merupakan kelas yang menyatakan sumber video dari mana video itu berasal misal USB kamera
3. **VideoCapabilities** merupakan kelas yang menunjukkan kemampuan video capture (USB kamera dalam menentukan property dari video seperti frame size, frame rate dll.

10.2. Latihan

Tujuan

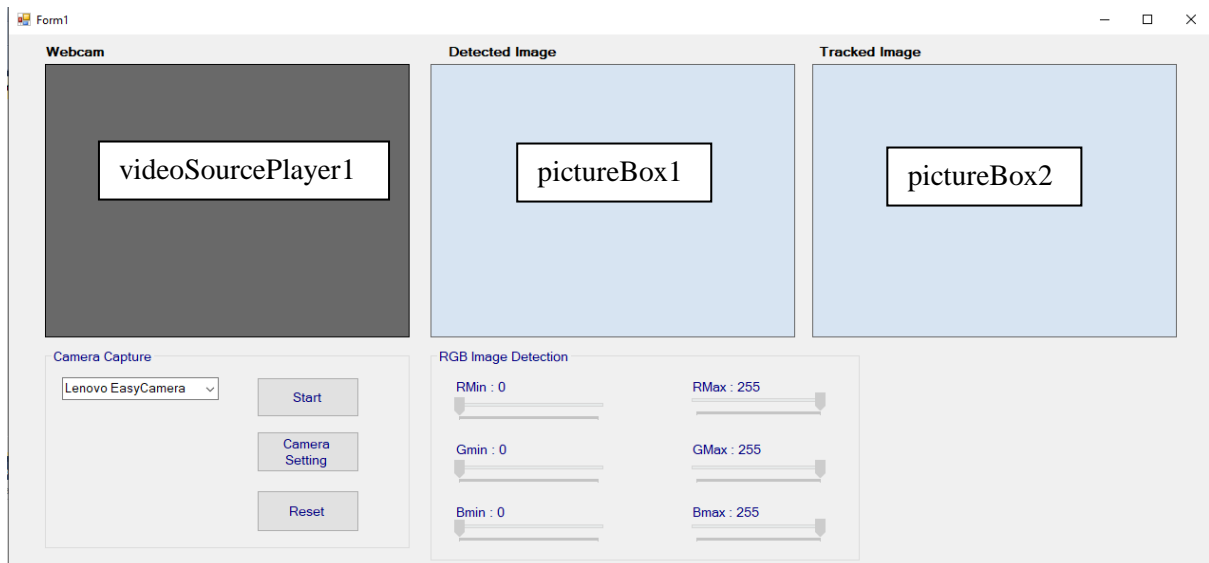
Memahami penggunaan AForge.NET dan mengaplikasikannya dalam mentracking objek bergerak dengan kamera menggunakan RGB color filtering.

Prosedur

1. Tambahkah projek baru
2. Tambahkan library **AForge.dll**, **AForge.Control.dll**, **AForge.Imaging.dll**, **AForge.Math.dll**, **AForge.Video.dll** dan **AForge.Video.DirectShow.dll** pada menu

References

3. Tambahkan beberapa dengan **Toolbox** pada form anda sehingga menjadi seperti gambar berikut:



4. Tambahkan library berikut pada program anda :

```
using AForge;
using AForge.Imaging;
using AForge.Imaging.Filters;
using AForge.Video;
using AForge.Video.DirectShow;
using System.Collections;
```

5. Tambahkan global variable sebagai berikut :

```
private FilterInfoCollection videoDevices;
private VideoCaptureDevice videoDevice;
private ArrayList listCamera = new ArrayList();

//image variabel
Bitmap sourceImage = null;
Bitmap detectedImage = null;

//trackbar variable
int Rmin, Rmax, Gmin, Gmax, Bmin, Bmax;
int TRACK_SPACE = 2; //space between trackBar
```

6. Tambahkan fungsi **trackBarEnable(); trackBarReset(); dan labelReset();** di bawah

InitializeComponent();

```
public Percobaan10()
{
    InitializeComponent();

    trackBarEnable(false);
    trackBarReset();
    labelReset();
}
```

7. Tambahkan juga fungsi berikut ini :

```
//RGB trackbar Enable
private void trackBarEnable(bool enable =true)
{
    //RGB trackbar Enable
    trackBarRmax.Enabled = enable;
    trackBarRmin.Enabled = enable;

    trackBarGmax.Enabled = enable;
    trackBarGmin.Enabled = enable;

    trackBarBmax.Enabled = enable;
    trackBarBmin.Enabled = enable;
}

private void trackBarReset()
{
    //RGB trackbar init
    trackBarRmax.Maximum = 255;
    trackBarRmin.Maximum = 255;

    trackBarGmax.Maximum = 255;
    trackBarGmin.Maximum = 255;

    trackBarBmax.Maximum = 255;
    trackBarBmin.Maximum = 255;

    //RGB trackbar reset
    trackBarRmax.Value = 255;
    trackBarRmin.Value = 0;

    trackBarGmax.Value = 255;
    trackBarGmin.Value = 0;

    trackBarBmax.Value = 255;
    trackBarBmin.Value = 0;

    Rmin = trackBarRmin.Value;
    Rmax = trackBarRmax.Value;
    Bmin = trackBarBmin.Value;
    Bmax = trackBarBmax.Value;
    Gmin = trackBarGmin.Value;
    Gmax = trackBarGmax.Value;
}

//RGB label reset
private void labelReset()
{
    labelRmax.Text = string.Format("RMax : {0}", trackBarRmax.Value);
    labelRmin.Text = string.Format("RMin : {0}", trackBarRmin.Value);

    labelGmax.Text = string.Format("GMax : {0}", trackBarGmax.Value);
    labelGmin.Text = string.Format("Gmin : {0}", trackBarGmin.Value);

    labelBmax.Text = string.Format("Bmax : {0}", trackBarBmax.Value);
    labelBmin.Text = string.Format("Bmin : {0}", trackBarBmin.Value);
}
```

8. Tambahkan fungsi-fungsi berikut untuk membuka dan menutup video source:

```
// usb camera definition
private static string _usbcamera;
public string usbcamera
{
    get { return _usbcamera; }
    set { _usbcamera = value; }
}

// opening the video source
private void OpenVideoSource(IVideoSource source)
{
    try
    {
        // set busy cursor
        this.Cursor = Cursors.WaitCursor;

        // stop current video source
        CloseCurrentVideoSource();

        // start new video source
        videoSourcePlayer1.VideoSource = source;
        videoSourcePlayer1.Start();

        this.Cursor = Cursors.Default;
    }
    catch { }
}

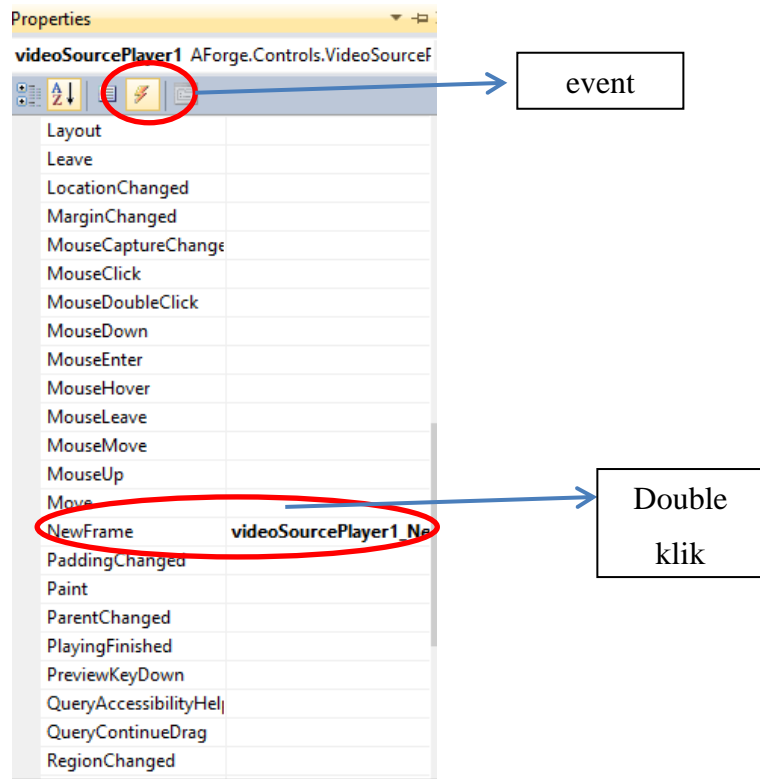
// closing the video source
public void CloseCurrentVideoSource()
{
    try
    {
        if (videoSourcePlayer1.VideoSource != null)
        {
            videoSourcePlayer1.SignalToStop();

            // wait ~ 3 seconds
            for (int i = 0; i < 30; i++)
            {
                if (!videoSourcePlayer1.IsRunning)
                    break;
                System.Threading.Thread.Sleep(100);
            }

            if (videoSourcePlayer1.IsRunning)
            {
                videoSourcePlayer1.Stop();
            }

            videoSourcePlayer1.VideoSource = null;
        }
    }
    catch { }
}
```

9. Untuk mengcapture frame menggunakan kamera, tambahkan program berikut dengan **meng-klik kanan** videoSourcePlayer1 → properties → event. Double klik **NewFrame**. Dan tambahkan program berikut :



```
private void videoSourcePlayer1_NewFrame(object sender, ref Bitmap image)
{
    try
    {
        sourceImage = image.Clone() as Bitmap;

        //detect the image
        colorFiltering(sourceImage);

        //traking the image
        objectTracking(sourceImage);
    }
    catch
    {
    }
}
```

10. Tambahkan fungsi berikut untuk *filter* dan *object tracking* :

```
private void colorFiltering(Bitmap srcImage)
{
    // create RGB color filter
    ColorFiltering filter = new ColorFiltering();

    // set color ranges to keep
    filter.Red = new IntRange(Rmin, Rmax);
    filter.Green = new IntRange(Gmin, Gmax);
    filter.Blue = new IntRange(Bmin, Bmax);

    // apply the filter
    detectedImage = filter.Apply(srcImage);

    //draw the picture
    pictureBox1.Image = detectedImage;
}

private void objectTracking(Bitmap srcImage)
{
    if (srcImage == null || detectedImage == null) return;

    //copy detected image to the new one
    Bitmap newImage = (Bitmap)detectedImage.Clone();

    //blob counter on the detected image
    BlobCounter bc = new BlobCounter();
    bc.MinHeight = 20;
    bc.MinWidth = 20;
    bc.FilterBlobs = true;
    bc.ObjectsOrder = ObjectsOrder.Area;
    bc.ProcessImage(newImage);
    Rectangle[] rects = bc.GetObjectsRectangles();
    foreach (Rectangle recs in rects)
    {
        if (rects.Length > 0)
        {
            Rectangle objectRect = rects[0];

            Graphics graph = Graphics.FromImage(srcImage);
            using (Pen pen = new Pen(Color.FromArgb(255, 0, 0), 10))
            {
                graph.DrawRectangle(pen, objectRect);
            }
            graph.Dispose();
        }
    }
    //draw tracked object on picture box
    pictureBox2.Image = srcImage;
}
```

11. Tambahkan fungsi berikut untuk open camera:

```
private void OpenCamera()
{
    try
    {
        usbcamera = comboBox1.SelectedIndex.ToString();
        videoDevices = new FilterInfoCollection(FilterCategory.VideoInputDevice);

        if (videoDevices.Count != 0)
        {
            // add all devices to combo
            foreach (FilterInfo device in videoDevices)
            {
                listCamera.Add(device.Name);
            }
        }
        else
        {
            MessageBox.Show("Camera devices found");
        }

        videoDevice = new
VideoCaptureDevice(videoDevices[Convert.ToInt32(usbcamera)].MonikerString);

        OpenVideoSource(videoDevice);
    }
    catch (Exception err)
    {
        MessageBox.Show(err.ToString());
    }
}
```

12. **Double klik** button **Start** dan tambahkan program berikut :

```
private void button1_Click(object sender, EventArgs e)
{
    OpenCamera();
    trackBarEnable();
}
```

13. **Double klik Form** dan tuliskan sub rutin program berikut :

```
private void Form1_Load(object sender, EventArgs e)
{
    videoDevices = new FilterInfoCollection(FilterCategory.VideoInputDevice);

    if (videoDevices.Count != 0)
    {
        // add all devices to combo
        foreach (FilterInfo device in videoDevices)
        {
            comboBox1.Items.Add(device.Name);
        }
    }
    else
    {
        comboBox1.Items.Add("No DirectShow devices found");
    }
    comboBox1.SelectedIndex = 0;
}
```


14. **Right klik Form** dan tambahkan rutin berikut :

```
private void Form1_FormClosed(object sender, FormClosedEventArgs e)
{
    if (videoCap != null && videoCap.IsRunning)
        videoCap.Stop();
}
```

15. **Double klik** semua **trackBar** dan tambahkan program berikut:

```
//TrackBar Rmin
private void trackBarRmin_Scroll(object sender, EventArgs e)
{
    if (trackBarRmax.Value - trackBarRmin.Value <= TRACK_SPACE)
        trackBarRmin.Value = trackBarRmax.Value - TRACK_SPACE;

    Rmin = trackBarRmin.Value;
    labelRmin.Text = string.Format("RMin : {0}", Rmin);
}

//TrackBar Rmax
private void trackBarRmax_Scroll(object sender, EventArgs e)
{
    if (trackBarRmax.Value - trackBarRmin.Value <= TRACK_SPACE)
        trackBarRmax.Value = trackBarRmin.Value + TRACK_SPACE;

    Rmax = trackBarRmax.Value;
    labelRmax.Text = string.Format("RMax : {0}", Rmax);
}

//TrackBar Gmin
private void trackBarGmin_Scroll(object sender, EventArgs e)
{
    if (trackBarGmax.Value - trackBarGmin.Value <= TRACK_SPACE)
        trackBarGmin.Value = trackBarGmax.Value - TRACK_SPACE;

    Gmin = trackBarGmin.Value;
    labelGmin.Text = string.Format("Gmin : {0}", Gmin);
}

//TrackBar Gmax
private void trackBarGmax_Scroll(object sender, EventArgs e)
{
    if (trackBarGmax.Value - trackBarGmin.Value <= TRACK_SPACE)
        trackBarGmax.Value = trackBarGmin.Value + TRACK_SPACE;

    Gmax = trackBarGmax.Value;
    labelGmax.Text = string.Format("GMax : {0}", Gmax);
}

//TrackBar Bmin
private void trackBarBmin_Scroll(object sender, EventArgs e)
{
    if (trackBarBmax.Value - trackBarBmin.Value <= TRACK_SPACE)
        trackBarBmin.Value = trackBarBmax.Value - TRACK_SPACE;

    Bmin = trackBarBmin.Value;
    labelBmin.Text = string.Format("Bmin : {0}", Bmin);
}
```

```
//TrackBar Bmax
private void trackBarBmax_Scroll(object sender, EventArgs e)
{
    if (trackBarBmax.Value - trackBarBmin.Value <= TRACK_SPACE)
        trackBarBmax.Value = trackBarBmin.Value + TRACK_SPACE;

    Bmax = trackBarBmax.Value;
    labelBmax.Text = string.Format("Bmax : {0}", Bmax);
}
}
```

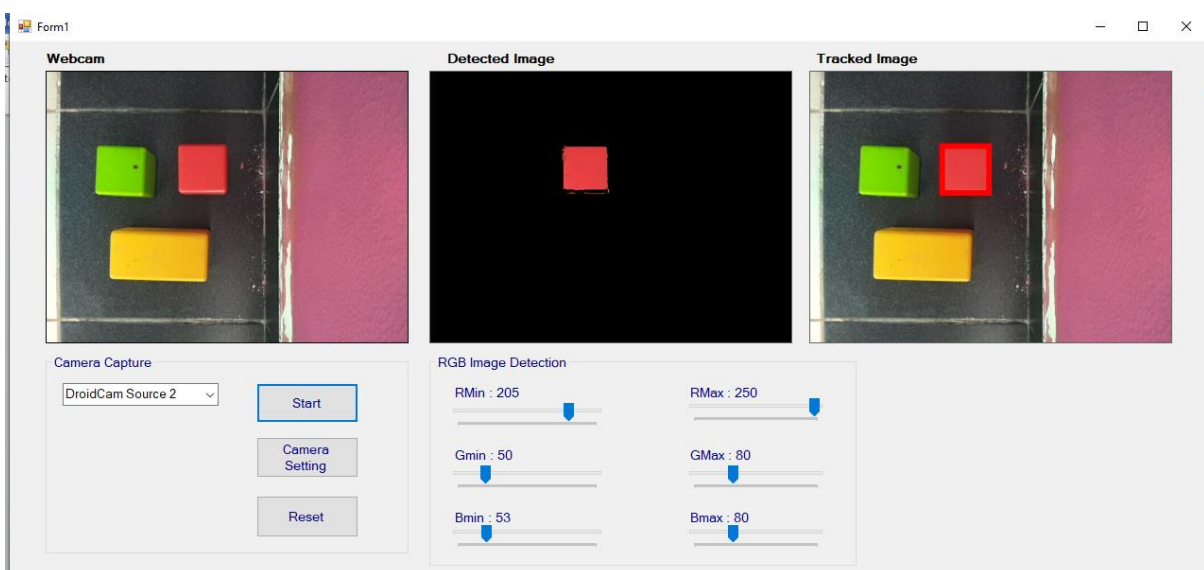
16. **Double klik** button **camera setting** dan tambahkan :

```
private void button2_Click(object sender, EventArgs e)
{
    if ((videoDevice != null))
    {
        try
        {
            ((VideoCaptureDevice)videoDevice).DisplayPropertyPage(this.Handle);
        }
        catch (NotSupportedException ex)
        {
            MessageBox.Show(ex.Message, "Error", MessageBoxButtons.OK,
            MessageBoxIcon.Error);
        }
    }
}
```

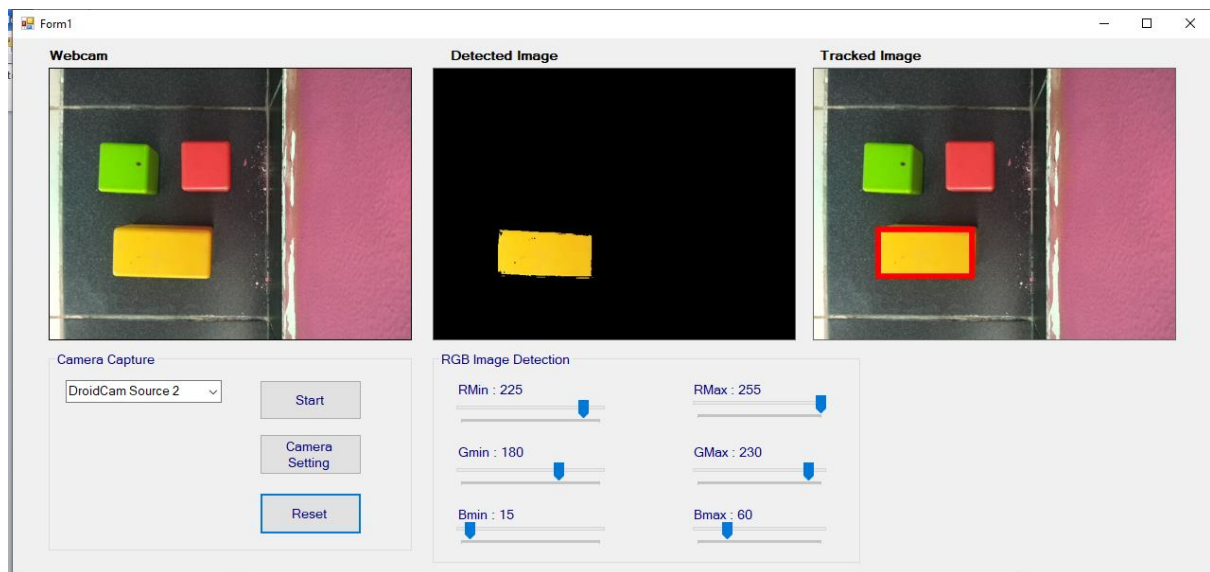
17. **Double klik** button **Reset** dan tambahkan :

```
private void button3_Click(object sender, EventArgs e)
{
    trackBarReset();
    labelReset();
}
```

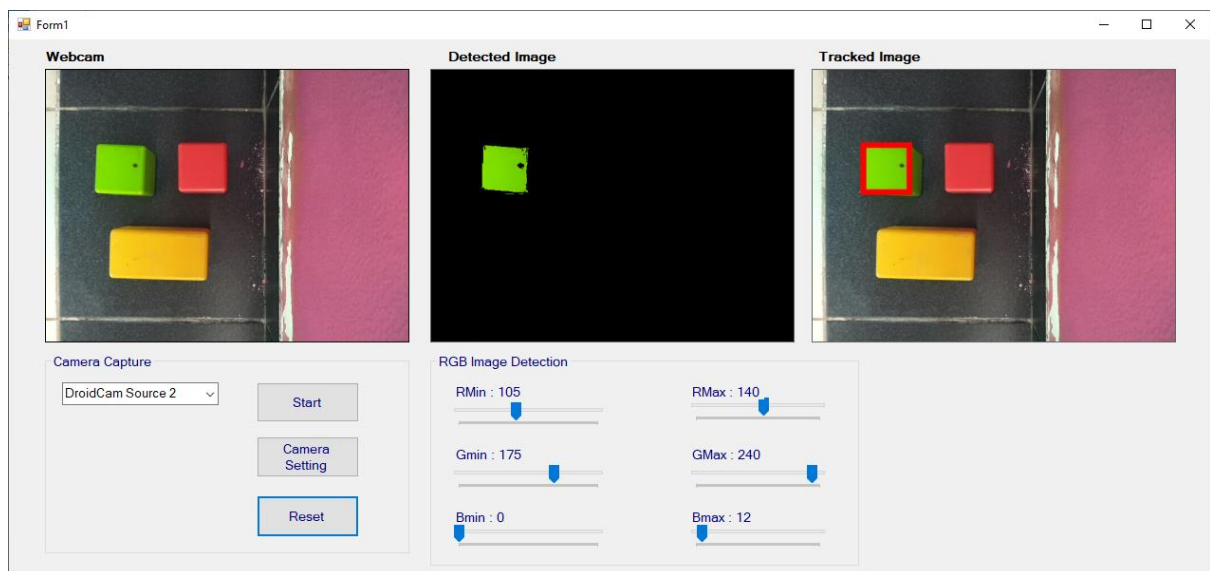
18. Jalankan program dan klik tombol **Start** dan geser **trackbar** sehingga hanya terdeteksi objek yang diinginkan



Objek berwarna merah (205<R<250, 50 <G<80, 53<B<80)



Objek berwarna kuning ($225 < R < 256$, $180 < G < 230$, $15 < B < 60$)



Objek berwarna hijau ($105 < R < 140$, $175 < G < 240$, $0 < B < 12$)

19. Coba ganti dengan objek yang lain

20. Klik **button Kamera Setting** dan akan muncul dialog sbb :

