**Лабораторна робота № 5**

Розробити програму для емуляції дисплейного модуля (розширені можливості).

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Групи кн21-1

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Варіант 14

1. Розширити можливості програми реалізованою в лабораторній роботі №2 (емулятор дисплейного модуля) шляхом реалізації команди draw\_text тільки з використанням команд малювання ліній. Програма повинна зберегти сумісність з програмами, розробленими в лабораторних роботах №3 і №4.

2. Інтерфейс бібліотеки GraphicsLib не змінювати.

3. Протокол обміну командами не змінювати.

**Хід роботи:**

**Лістинг програми(Client):**

unit Maim;

interface

uses

System.SysUtils, System.Types, System.UITypes, System.Classes, System.Variants,

FMX.Types, FMX.Controls, FMX.Forms, FMX.Graphics, FMX.Dialogs,

FMX.Controls.Presentation, FMX.StdCtrls, IdBaseComponent, IdComponent,

IdUDPBase, IdUDPClient, FMX.Memo.Types, FMX.ScrollBox, FMX.Memo, System.DateUtils, idGlobal,

FMX.Edit, FMX.ComboEdit, FMX.Objects;

type TPacket = packed record

msLen:Byte;

colorarray:array [1..40,1..40] of cardinal;

w:integer;

h:integer;

msg:string[255];

end;

const commands: array [1..8] of string = (

'drawline', 'drawellipse', 'drawtext', 'clear', 'drawimage','fillroundedrectangle','drawpixel','drawsymbol'

);

// Перечисление для типов команд

type TCommand=(DRAW\_LINE, DRAW\_ELLIPSE, DRAW\_TEXT, CLEAR, DRAW\_IMAGE, FILL\_ROUNDED\_RECTANGLE, DRAW\_PIXEL, DRAW\_SYMBOL);

type

TForm1 = class(TForm)

IdUDPClient1: TIdUDPClient;

Button1: TButton;

Memo1: TMemo;

ComboEdit1: TComboEdit;

Label1: TLabel;

Image1: TImage;

procedure Button1Click(Sender: TObject);

private

{ Private declarations }

bmp:TBitmap;

packet:TPacket;

send\_data:TIdBytes;

sendcommand:TCommand;

public

{ Public declarations }

function DrawPixelEncode(const sendcommand, px1,py1,parcolor:string):string;

function DrawLineEncode(const sendcommand, parx1,pary1,parx2,pary2,parcolor:string):string;

function DrawSymbolEncode(const sendcommand, symbol, x,y,parcolor:string):string;

function DrawEllipseEncode(const sendcommand, elx1,ely1,elx2,ely2,parcolor:string):string;

function DrawTextEncode(const sendcommand, tx1,ty1,tx2,ty2,text,parcolor:string):string;

function ClearEncode(const sendcommand:string; const parcolor:string):string;

function DrawImageEncode(const sendcommand:string; width,heigth:string):string;

function FillRoundedRectangleEncode(const sendcommand:string; px1,py1,px2,py2,radius,parcolor:string):string;

end;

var

Form1: TForm1;

implementation

{$R \*.fmx}

{$R \*.iPhone47in.fmx IOS}

procedure TForm1.Button1Click(Sender: TObject);

var spl:TArray<string>; s:string; i:integer; iw,jw:integer; b:TBitmapData;

begin

packet.msLen:=Length(Memo1.Text);

SetLength(packet.msg,packet.msLen);

s:=Memo1.Text;

spl:=s.Split([' ']);

for i:=1 to 8 do

begin

if commands[i]=spl[0] then

begin

sendcommand:=TCommand(i-1);

case sendcommand of

TCommand.DRAW\_LINE:

packet.msg:=DrawLineEncode((i-1).ToString,spl[1],spl[2],spl[3],spl[4],spl[5]);

TCommand.DRAW\_ELLIPSE:

packet.msg:=DrawEllipseEncode((i-1).ToString,spl[1],spl[2],spl[3],spl[4],spl[5]);

TCommand.DRAW\_TEXT:

packet.msg:=DrawTextEncode((i-1).ToString,spl[1],spl[2],spl[3],spl[4],spl[5],spl[6]);

TCommand.CLEAR:

packet.msg:=ClearEncode((i-1).ToString,spl[1]);

TCommand.DRAW\_IMAGE:

begin

packet.msg:=DrawImageEncode((i-1).ToString,spl[1],spl[2]);

bmp:=TBitmap.CreateFromFile(spl[3]);

packet.w:=bmp.Width;

packet.h:=bmp.Height;

bmp.Map(TMapAccess.Read,b);

for iw:=1 to Round(bmp.Width) do

for jw:=1 to Round(bmp.Height) do

packet.colorarray[iw,jw]:=b.GetPixel(iw,jw);

bmp.Unmap(b);

Image1.Bitmap.Assign(bmp);

end;

TCommand.FILL\_ROUNDED\_RECTANGLE:

begin

packet.msg:=FillRoundedRectangleEncode((i-1).ToString,spl[1],spl[2],spl[3],spl[4],spl[5],spl[6]);

end;

TCommand.DRAW\_PIXEL:

begin

packet.msg:=DrawPixelEncode((i-1).ToString,spl[1],spl[2],spl[3]);

end;

TCommand.DRAW\_SYMBOL:

begin

packet.msg:=DrawSymbolEncode((i-1).ToString,spl[1],spl[2],spl[3],spl[4]);

end;

end;

end;

end;

IdUDPClient1.Active:=true;

IdUDPClient1.Port:=5000;

IdUDPClient1.Host:=ComboEdit1.Text;

IdUDPClient1.Connect;

if IdUDPClient1.Connected then

begin

SetLength(send\_data,sizeof(packet));

Move(packet,send\_data[0],sizeof(packet));

IdUDPClient1.SendBuffer(send\_data);

end;

IdUDPClient1.Active:=false;

end;

function TForm1.ClearEncode(const sendcommand:string; const parcolor: string): string;

var command:integer;

begin

try

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Цвет неверный!!!');

Result:='3 '+'000000';

end;

end;

end;

function TForm1.DrawSymbolEncode(const sendcommand, symbol, x, y, parcolor: string): string;

var xx,yy: Double; command:integer;

begin

try

xx:=Double.Parse(x);

yy:=Double.Parse(y);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+symbol+' '+xx.ToString+' '+yy.ToString+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Координаты буквы неверны!!!');

Result:='7 0 0 0 0';

end;

end;

end;

function TForm1.DrawEllipseEncode(const sendcommand, elx1, ely1, elx2, ely2,

parcolor: string): string;

var x1,y1,x2,y2,command:integer;

begin

try

x1:=Integer.Parse(elx1);

y1:=Integer.Parse(ely1);

x2:=Integer.Parse(elx2);

y2:=Integer.Parse(ely2);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+x1.ToString+' '+y1.ToString+' '+x2.ToString+' '+y2.ToString+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Координаты эллипса неверны!!!');

Result:='1 0 0 0 0 '+parcolor;

end;

end;

end;

function TForm1.DrawImageEncode(const sendcommand: string; width,

heigth: string): string;

var w,h,command:integer;

begin

try

w:=Integer.Parse(width);

h:=Integer.Parse(heigth);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+w.ToString+' '+h.ToString;

except on EConvertError do

begin

ShowMessage('размеры неверны!!!');

Result:='4 0 0';

end;

end;

end;

function TForm1.DrawLineEncode(const sendcommand, parx1, pary1, parx2, pary2,

parcolor: string): string;

var x1,y1,x2,y2,command:integer;

begin

try

x1:=Integer.Parse(parx1);

y1:=Integer.Parse(pary1);

x2:=Integer.Parse(parx2);

y2:=Integer.Parse(pary2);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+x1.ToString+' '+y1.ToString+' '+x2.ToString+' '

+y2.ToString+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Координаты линии неверны!!!');

Result:='0 0 0 0 0 '+parcolor;

end;

end;

end;

function TForm1.DrawPixelEncode(const sendcommand, px1, py1,

parcolor: string): string;

var x1,y1,command:integer;

begin

try

x1:=Integer.Parse(px1);

y1:=Integer.Parse(py1);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+x1.ToString+' '+y1.ToString+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Координаты линии неверны!!!');

Result:='6 0 0 '+parcolor;

end;

end;

end;

function TForm1.DrawTextEncode(const sendcommand, tx1, ty1, tx2, ty2, text,

parcolor: string): string;

var x1,y1,x2,y2,command:integer;

begin

try

x1:=Integer.Parse(tx1);

y1:=Integer.Parse(ty1);

x2:=Integer.Parse(tx2);

y2:=Integer.Parse(ty2);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+x1.ToString+' '+y1.ToString+' '+x2.ToString+' '

+y2.ToString+' '+text+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Координаты линии неверны!!!');

Result:='2 0 0 0 0 '+text+' '+parcolor;

end;

end;

end;

function TForm1.FillRoundedRectangleEncode(const sendcommand: string; px1, py1,

px2, py2, radius, parcolor: string): string;

var x1,y1,x2,y2,rad,command,color:integer;

begin

try

x1:=Integer.Parse(px1);

y1:=Integer.Parse(py1);

x2:=Integer.Parse(px2);

y2:=Integer.Parse(py2);

rad:=Integer.Parse(radius);

command:=Integer.Parse(sendcommand);

Result:=command.ToString+' '+x1.ToString+' '+y1.ToString+' '+

x2.ToString+' '+y2.ToString+' '+rad.ToString+' '+parcolor;

except on EConvertError do

begin

ShowMessage('Ошибка!!!');

Result:='5 0 0 0 0 0 0';

end;

end;

end;

end.

**Лістинг програми(Server):**

unit Main;

interface

uses

System.SysUtils, System.Types, System.UITypes, System.Classes, System.Variants,

FMX.Types, FMX.Controls, FMX.Forms, FMX.Graphics, FMX.Dialogs,

FMX.Controls.Presentation, FMX.StdCtrls, IdBaseComponent, IdComponent,

IdUDPBase, IdUDPServer, IdGlobal, IdSocketHandle, FMX.Memo.Types,

FMX.ScrollBox, FMX.Memo, System.DateUtils, FMX.Objects, MyCommands, System.Generics.Collections;

const symbols: array [1..8] of string = (

'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H'

);

// Запись для приема данных от клиента

type TPacket = packed record

msLen:Byte;

colorarray:array [1..40,1..40] of cardinal;

w:integer;

h:integer;

msg:string[255];

end;

// Параметры картинки

type TPicData = class

pic:TBitmap;

x:Double;

y:Double;

constructor Create(var x,y:Double;var pic:TBitmap); overload;

end;

// Параметры надписи

type TTextData = class

text:string;

x1:Double;

y1:Double;

x2:Double;

y2:Double;

color:string;

constructor Create(var text:string; var x1,y1,x2,y2:Double; color:string); overload;

end;

type TEllipseData = class

x1:Double;

y1:Double;

x2:Double;

y2:Double;

color:string;

constructor Create(var x1,y1,x2,y2:Double; color:string); overload;

end;

type TPixelData = class

x1:Double;

y1:Double;

color:string;

constructor Create(var x1,y1:Double; color:string); overload;

end;

type TSymbolData = class

x:Double;

y:Double;

color:string;

symbpos:integer;

constructor Create(var x, y : Double; color : string; symbpos : integer); overload;

end;

type TFillRoundedRectangleData = class

x1:Integer;

y1:Integer;

x2:Integer;

y2:Integer;

radius:Integer;

color:string;

constructor Create(var x1,y1,x2,y2,radius:Integer;color:string); overload;

end;

// Параметры линии

type TLineData = class

p1:TPointF;

p2:TPointF;

color:string;

constructor Create(var p1,p2:TPointF; color:string); overload;

end;

// Перечисление для типов команд

type TCommand=(DRAW\_LINE, DRAW\_ELLIPSE, DRAW\_TEXT, CLEAR, DRAW\_IMAGE, FILL\_ROUNDED\_RECTANGLE, DRAW\_PIXEL, DRAW\_SYMBOL);

type

TForm1 = class(TForm)

IdUDPServer1: TIdUDPServer;

ToolBar1: TToolBar;

Label2: TLabel;

PaintBox1: TPaintBox;

procedure FormCreate(Sender: TObject);

procedure IdUDPServer1UDPRead(AThread: TIdUDPListenerThread;

const AData: TIdBytes; ABinding: TIdSocketHandle);

procedure PaintBox1Paint(Sender: TObject; Canvas: TCanvas);

private

{ Private declarations }

bmp:TBitmap;

packet:TPacket;

command:TCommand;

drawcommand:integer;

piclist:TList<TPicData>;

textlist:TList<TTextData>;

linelist:TList<TLineData>;

ellipselist:TList<TEllipseData>;

fillroundedrectanglelist:TList<TFillRoundedRectangleData>;

pixellist:TList<TPixelData>;

symbollist:TList<TSymbolData>;

public

{ Public declarations }

end;

var

Form1: TForm1;

implementation

{$R \*.fmx}

procedure TForm1.FormCreate(Sender: TObject);

begin

IdUDPServer1.Active:=true;

TMyCommands.linepath:=TPathData.Create;

TMyCommands.ellipsepath:=TPathData.Create;

TMyCommands.clearcolor:='000000';

piclist:=TList<TPicData>.Create;

textlist:=TList<TTextData>.Create;

linelist:=TList<TLineData>.Create;

ellipselist:=TList<TEllipseData>.Create;

fillroundedrectanglelist:=TList<TFillRoundedRectangleData>.Create;

pixellist:=TList<TPixelData>.Create;

symbollist:=TList<TSymbolData>.Create;

end;

procedure TForm1.IdUDPServer1UDPRead(AThread: TIdUDPListenerThread;

const AData: TIdBytes; ABinding: TIdSocketHandle);

var s:string; i:integer; spl:TArray<string>; iw,jw:integer;

b1:TBitmapData; picdata:TPicData; textdata:TTextData;

linedata:TLineData; ellipsedata:TEllipseData;

fillroundedrectangledata:TFillRoundedRectangleData;

pixeldata:TPixelData; px,py:Double; mysymboldata:TSymbolData;

symbolpos:integer; symbolx,symboly:Double; symbolcolor:string;

begin

Move(AData[0],packet,sizeof(packet));

s:=packet.msg;

spl:=s.Split([' ']);

// Парсим полученную команду от клиента

command:=TCommand(Integer.Parse(spl[0]));

case command of

TCommand.DRAW\_LINE:

begin

drawcommand:=Integer.Parse(spl[0]);

TMyCommands.PrepareLine(spl[1],spl[2],spl[3],spl[4],spl[5]);

linedata:=TLineData.Create(TMyCommands.p1,TMyCommands.p2,TMyCommands.linecolor);

linelist.Add(linedata);

PaintBox1.Repaint;

end;

TCommand.DRAW\_ELLIPSE:

begin

drawcommand:=Integer.Parse(spl[0]);

TMyCommands.PrepareEllipse(spl[1],spl[2],spl[3],spl[4],spl[5]);

ellipsedata:=TEllipseData.Create(TMyCommands.x1\_ellipse,TMyCommands.y1\_ellipse,

TMyCommands.x2\_ellipse,TMyCommands.y2\_ellipse,TMyCommands.ellipsecolor);

ellipselist.Add(ellipsedata);

PaintBox1.Repaint;

end;

TCommand.DRAW\_TEXT:

begin

drawcommand:=Integer.Parse(spl[0]);

TMyCommands.PrepareText(spl[1],spl[2],spl[3],spl[4],spl[5],spl[6]);

textdata:=TTextData.Create(TMyCommands.textout,TMyCommands.x1\_text,TMyCommands.y1\_text,

TMyCommands.x2\_text,TMyCommands.y2\_text,TMyCommands.textcolor);

textlist.Add(textdata);

PaintBox1.Repaint;

end;

TCommand.CLEAR:

begin

drawcommand:=Integer.Parse(spl[0]);

TMyCommands.PrepareClear(spl[1]);

piclist.Clear;

textlist.Clear;

linelist.Clear;

pixellist.Clear;

symbollist.Clear;

ellipselist.Clear;

fillroundedrectanglelist.Clear;

Form1.Fill.Color:=StrToInt('$ff'+TMyCommands.clearcolor);

PaintBox1.Repaint;

end;

TCommand.DRAW\_IMAGE:

begin

drawcommand:=Integer.Parse(spl[0]);

TMyCommands.PrepareDrawImage(spl[1],spl[2]);

bmp:=TBitmap.Create();

bmp.SetSize(packet.w,packet.h);

bmp.Map(TMapAccess.Write,b1);

for iw:=1 to Round(bmp.Width) do

for jw:=1 to Round(bmp.Height) do

begin

b1.SetPixel(iw,jw,packet.colorarray[iw,jw]);

end;

bmp.Unmap(b1);

picdata:=TPicData.Create(TMyCommands.ximage,TMyCommands.yimage,bmp);

piclist.Add(picdata);

PaintBox1.Repaint;

end;

TCommand.FILL\_ROUNDED\_RECTANGLE:

begin

TMyCommands.PrepareFillRoundedRectangle(spl[1],spl[2],spl[3],spl[4],spl[5],spl[6]);

fillroundedrectangledata:=TFillRoundedRectangleData.Create(TMyCommands.x1,TMyCommands.y1,

TMyCommands.x2,TMyCommands.y2,TMyCommands.radius,TMyCommands.fillroundedrectanglecolor);

fillroundedrectanglelist.Add(fillroundedrectangledata);

PaintBox1.Repaint;

end;

TCommand.DRAW\_PIXEL:

begin

TMyCommands.PreparePixel(spl[1],spl[2],spl[3]);

px:=TMyCommands.ppoint.X;

py:=TMyCommands.ppoint.Y;

pixeldata:=TPixelData.Create(px, py, TMyCommands.pixelcolor);

pixellist.Add(pixeldata);

PaintBox1.Repaint;

end;

TCommand.DRAW\_SYMBOL:

begin

TMyCommands.PrepareSymbol(spl[1],spl[2],spl[3],spl[4]);

for symbolpos:=1 to 8 do

begin

if TMyCommands.symbol=symbols[symbolpos] then

begin

symbolx:=TMyCommands.sx;

symboly:=TMyCommands.sy;

symbolcolor:=TMyCommands.symbolcolor;

mysymboldata:=TSymbolData.Create(symbolx, symboly, symbolcolor, (symbolpos-1));

symbollist.Add(mysymboldata);

end;

end;

PaintBox1.Repaint;

end;

end;

end;

procedure TForm1.PaintBox1Paint(Sender: TObject; Canvas: TCanvas);

var i:integer; p:TPicData; t:TTextData; l:TLineData; e:TEllipseData;

frr:TFillRoundedRectangleData; pixel:TPixelData; a:TSymbolData;

begin

PaintBox1.Canvas.BeginScene();

for l in linelist do

TMyCommands.DrawMyLine(l.p1,l.p2,Canvas,StrToInt('$ff'+l.color));

for e in ellipselist do

TMyCommands.DrawMyEllipse(e.x1,e.y1,e.x2,e.y2,Canvas,StrToInt('$ff'+e.color));

for t in textlist do

TMyCommands.DrawMyText(t.x1,t.y1,t.x2,t.y2,

t.text, 30, Canvas, StrToInt('$ff'+t.color));

for p in piclist do

TMyCommands.DrawImage(p.x,p.y,p.pic,Canvas);

for frr in fillroundedrectanglelist do

TMyCommands.FillRoundedRectangle(frr.x1,frr.y1,frr.x2,frr.y2,frr.radius,

Canvas,StrToInt('$ff'+frr.color));

for pixel in pixellist do

begin

TMyCommands.DrawMyPixel(TPointF.Create(pixel.x1,pixel.y1),

Canvas,StrToInt('$ff'+pixel.color));

end;

for a in symbollist do

begin

TMyCommands.DrawSymbol(a.symbpos,TPointF.Create(a.x,a.y),Canvas,StrToInt('$ff'+a.color));

end;

PaintBox1.Canvas.EndScene;

end;

{ TPicData }

constructor TPicData.Create(var x, y: Double; var pic: TBitmap);

begin

Self.x:=x;

Self.y:=y;

Self.pic:=pic;

end;

{ TTextData }

constructor TTextData.Create(var text:string; var x1,y1,x2,y2:Double; color:string);

begin

Self.text:=text;

Self.x1:=x1;

Self.y1:=y1;

Self.x2:=x2;

Self.y2:=y2;

Self.color:=color;

end;

{ TLineData }

constructor TLineData.Create(var p1,p2:TPointF; color:string);

begin

Self.p1:=p1;

Self.p2:=p2;

Self.color:=color;

end;

{ TEllipseData }

constructor TEllipseData.Create(var x1, y1, x2, y2: Double; color: string);

begin

Self.x1:=x1;

Self.y1:=y1;

Self.x2:=x2;

Self.y2:=y2;

Self.color:=color;

end;

{ TFillRoundedRectangleData }

constructor TFillRoundedRectangleData.Create(var x1, y1, x2, y2,

radius: Integer; color: string);

begin

Self.x1:=x1;

Self.y1:=y1;

Self.x2:=x2;

Self.y2:=y2;

Self.radius:=radius;

Self.color:=color;

end;

{ TPixelData }

constructor TPixelData.Create(var x1, y1: Double; color: string);

begin

Self.x1:=x1;

Self.y1:=y1;

Self.color:=color;

end;

{ TAData }

constructor TSymbolData.Create(var x, y: Double; color: string; symbpos : integer);

begin

Self.symbpos:=symbpos;

Self.x:=x;

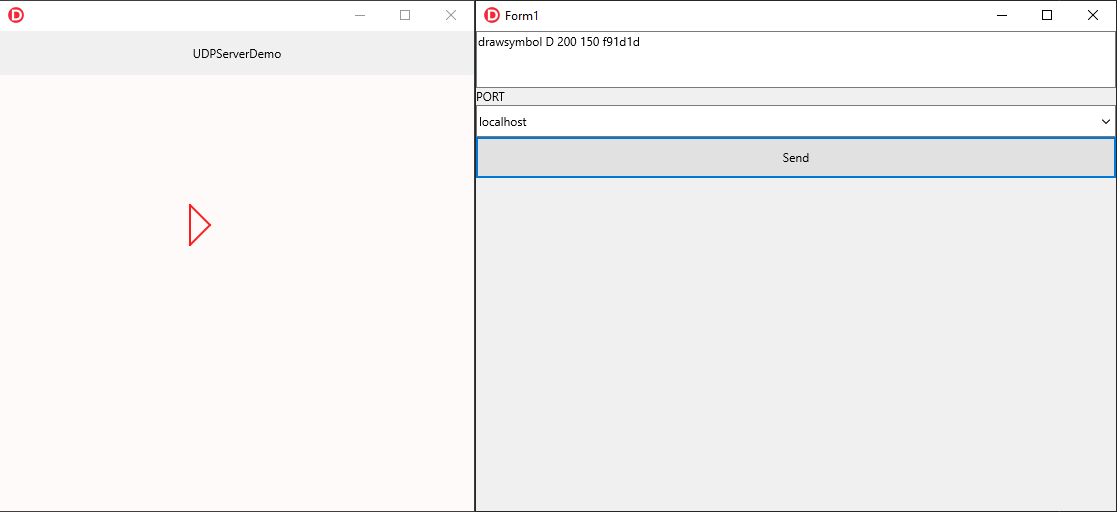
Self.y:=y;

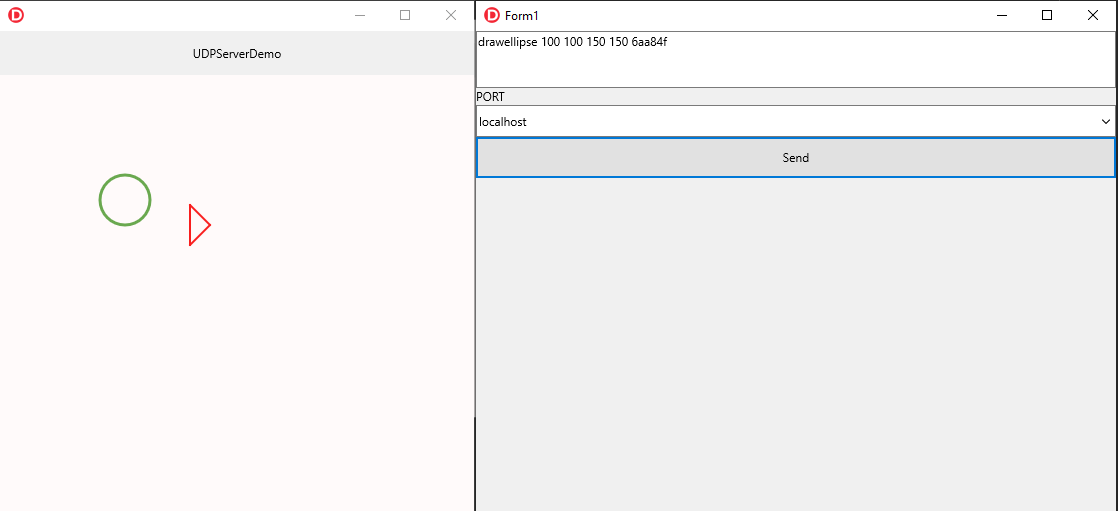
Self.color:=color;

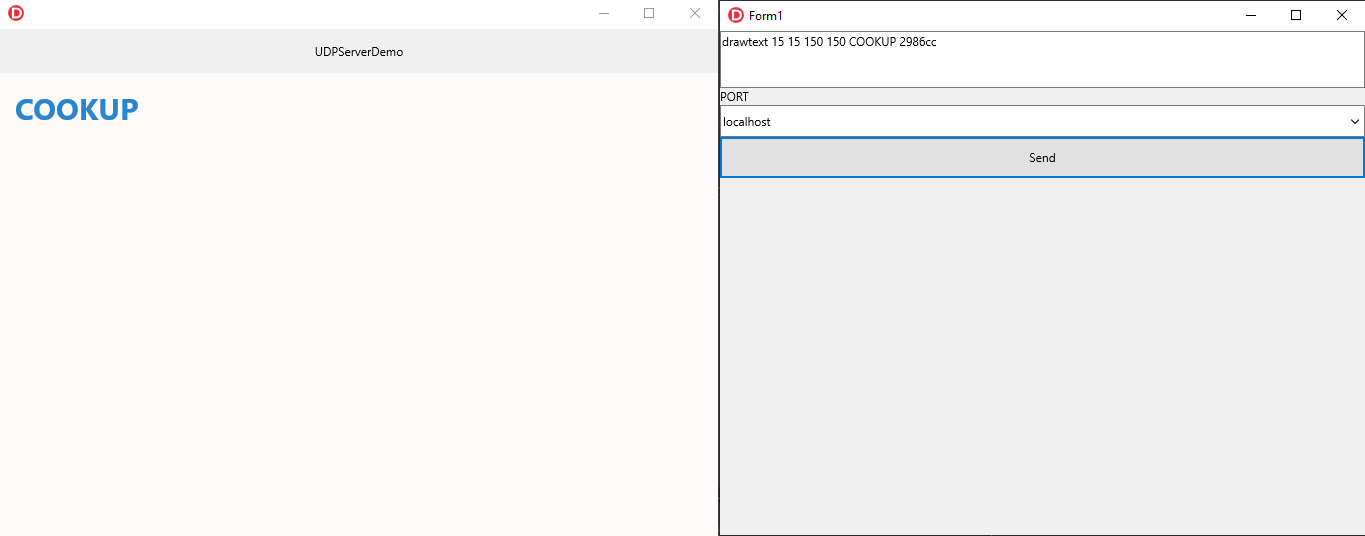
end;

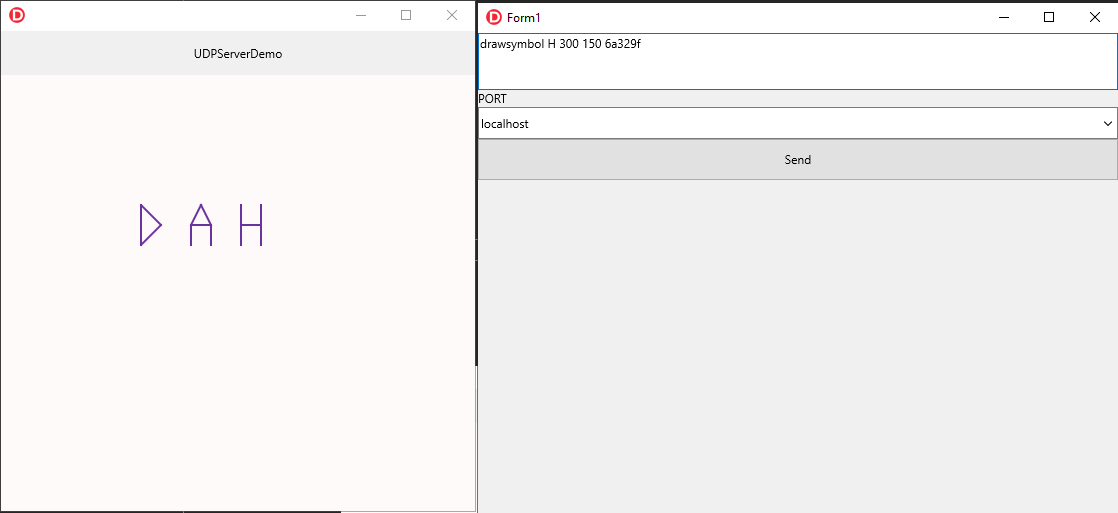
end.

**Результати роботи:**









**Висновок:** розробив програму для емуляції дисплейного модуля (розширені можливості).