```
`include "C:/altera/13.0sp1/BCD/DE0_VGA.v"
`include "../Final_Project/Make_box/makebox.sv"
`include "../Final_project/Slow_clock/slowclock.sv"

module finalproj1(CLOCK_50, VGA_R, VGA_G, VGA_B, VGA_HS, VGA_VS,SW,Button);

input [9:0] SW;
input Button;
input    wire                    CLOCK_50;

output  wire    [3:0]           VGA_R;              //Output Red
output  wire    [3:0]           VGA_G;              //Output Green
output  wire    [3:0]           VGA_B;              //Output Blue

output  wire    [0:0]           VGA_HS;                 //Horizontal Sync
output  wire    [0:0]           VGA_VS;                 //Vertical Sync

wire                    [9:0]           X_pix;              //Location in X of the driver min is 0
and max is 640
wire                    [9:0]           Y_pix;              //Location in Y of the driver min is 0
and max is 480 where 480 is on the bottom

wire                    [0:0]           H_visible;          //H_blank?
wire                    [0:0]           V_visible;          //V_blank?

wire                    [0:0]           pixel_clk;          //Pixel clock. Every clock a pixel is
being drawn.
wire                    [9:0]           pixel_cnt;          //How many pixels have been
output.

reg                     [11:0]          pixel_color;    //12 Bits representing color of pixel, 4 bits
for R, G, and B
                                                                    //4 bits for Blue are in
most significant position, Red in least
reg [1:0]       player_1_score;
reg [1:0]       player_2_score;


//Draw player one
        wire [9:0] player_1_paddle_width=10;
        wire [9:0] player_1_paddle_height=120;
        wire [9:0] player_1_paddle_x_location=10;
        reg [9:0] player_1_paddle_y_location=120;
        reg player_1_paddle;
```

```
        make_box(
        .X_pix(X_pix),
        .Y_pix(Y_pix),
        .box_width(player_1_paddle_width),
        .box_height(player_1_paddle_height),
        .box_x_location(player_1_paddle_x_location),
        .box_y_location(player_1_paddle_y_location),
        .pixel_clk(pixel_clk),
        .box(player_1_paddle)
        );
//player 2
        wire [9:0] player_2_paddle_width=10;
        wire [9:0] player_2_paddle_height=120;
        wire [9:0] player_2_paddle_x_location=620;
        reg [9:0] player_2_paddle_y_location=120;
        reg player_2_paddle;

        make_box(
        .X_pix(X_pix),
        .Y_pix(Y_pix),
        .box_width(player_2_paddle_width),
        .box_height(player_2_paddle_height),
        .box_x_location(player_2_paddle_x_location),
        .box_y_location(player_2_paddle_y_location),
        .pixel_clk(pixel_clk),
        .box(player_2_paddle)
        );
//ball
        wire [9:0] ball_width=10;
        wire [9:0] ball_height=10;
        reg [9:0] ball_x_location=320;
        reg [9:0] ball_y_location=240;
        reg ball_paddle;

        make_box(
        .X_pix(X_pix),
        .Y_pix(Y_pix),
        .box_width(ball_width),
        .box_height(ball_height),
        .box_x_location(ball_x_location),
        .box_y_location(ball_y_location),
        .pixel_clk(pixel_clk),
        .box(ball)
```

```
	);
	//ball velocity
	//1'b01 is 1
	//1'b10 is -1
	//1'b11 is 0
	reg [1:0] ball_x_velocity=1'b01;
	reg [1:0] ball_y_velocity=1'b11;


	wire slowclk;
	wire reset;

	slowclock(.slowclk(slowclk),.reset(reset),.fastclk(CLOCK_50));

always@(posedge slowclk)
	begin
		//move the ball
		if(ball_x_velocity==1'b01) ball_x_location=ball_x_location+1;
		if(ball_x_velocity==1'b10) ball_x_location=ball_x_location-1;
		if(ball_x_velocity==1'b11) ball_x_location=ball_x_location;
		if(ball_y_velocity==1'b01) ball_y_location=ball_y_location+1;
		if(ball_y_velocity==1'b10) ball_y_location=ball_y_location-1;
		if(ball_y_velocity==1'b11) ball_y_location=ball_y_location;

		//update the velocity

		//if hitting player 2 (right) paddle turn around

if(((ball_x_location+ball_width)==player_2_paddle_x_location)&&((ball_y_location>=player_2_p
addle_y_location)&&(ball_y_location<=(player_2_paddle_y_location+player_2_paddle_height)))
)
			begin
			ball_x_velocity=1'b10;
			if(SW[1]==1) ball_y_velocity=1'b10;
			if(SW[0]==1) ball_y_velocity=1'b01;
			end
		//if hitting player 1 (left) paddle turn around

if(((ball_x_location)==(player_1_paddle_x_location+player_1_paddle_width))&&((ball_y_location
>=player_1_paddle_y_location)&&(ball_y_location<=(player_1_paddle_y_location+player_1_pa
ddle_height))))
			begin
			ball_x_velocity=1'b01;
			if(SW[8]==1) ball_y_velocity=1'b10;
```

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                if(SW[7]==1) ball_y_velocity=1'b01;
                end
            //if player 1 scored
            if((ball_x_location+ball_width)>=640)
                begin
                    player_1_score+=1;
                    ball_x_location=320;
                    ball_y_location=240;
                    ball_y_velocity=1'b11;
                    ball_x_velocity=1'b01;//send towards player 2 with no y velocity
                end
            //if player 2 scored
            if(ball_x_location==0)
                begin
                    player_2_score+=1;
                    ball_x_location=320;
                    ball_y_location=240;
                    ball_y_velocity=1'b11;
                    ball_x_velocity=1'b10;//send towards player 1 with no y velocity
                end
            if(ball_y_location>=(480-ball_height)) ball_y_velocity=1'b10;
            if(ball_y_location==0) ball_y_velocity=1'b01;

            //move player 1
            //up if SW[1]=1,down if SW[0]=1 and stationary if both are 1 or both are zero
            if(((SW[8]==1)&&(SW[7]==0))&&(player_1_paddle_y_location>0))
player_1_paddle_y_location-=1;

if(((SW[8]==0)&&(SW[7]==1))&&(player_1_paddle_y_location<(480-player_1_paddle_height)))
player_1_paddle_y_location+=1;

            //move player 2
            //up if SW[3]=1,down if SW[2]=1 and stationary if both are 1 or both are zero
            if(((SW[1]==1)&&(SW[0]==0))&&(player_2_paddle_y_location>0))
player_2_paddle_y_location-=1;

if(((SW[1]==0)&&(SW[0]==1))&&(player_2_paddle_y_location<(480-player_2_paddle_height)))
player_2_paddle_y_location+=1;

            if(Button==0) player_1_score=0;
            if(Button==0) player_2_score=0;
            if(Button==0) ball_x_location=320;
            if(Button==0) ball_y_location=240;
            if(Button==0)player_2_paddle_y_location=120;
```

```
		if(Button==0)player_1_paddle_y_location=120;

	end

always @(posedge pixel_clk)//everytime we are at a pixel drawing time
	begin
		//Drawing player one based on the make_box module

if((player_1_paddle&&(player_2_score==0))||(player_2_paddle&&(player_1_score==0)))pixel_c
olor <= 12'b0000_1111_0000;
		else
if((player_1_paddle&&(player_2_score==1))||(player_2_paddle&&(player_1_score==1)))pixel_c
olor <= 12'b0000_1111_1111;
		else
if((player_1_paddle&&(player_2_score==2))||(player_2_paddle&&(player_1_score==2)))pixel_c
olor <= 12'b0000_1010_1111;
		else
if((player_1_paddle&&(player_2_score==3))||(player_2_paddle&&(player_1_score==3)))pixel_c
olor <= 12'b0000_0000_1111;
		else if(ball)begin

if((SW[9]==1)&&(SW[6]==1)&&(SW[4]==1)&&(SW[5]==0)&&(SW[3]==0))begin
				if(ball_x_location<500&&ball_x_location>150)begin
					if(ball)pixel_color<=12'b0000_0000_0000;
				end
			else if(ball)pixel_color<=12'b1111_1111_1111;
			end
			else if(ball)pixel_color<=12'b1111_1111_1111;
			end
		//else if(ball)pixel_color<=12'b1111_1111_1111;

		else pixel_color<=12'b0000_0000_0000;
	end

		//Pass pins and current pixel values to display driver
		DE0_VGA VGA_Driver
		(
			.clk_50(CLOCK_50),
			.pixel_color(pixel_color),
			.VGA_BUS_R(VGA_R),
			.VGA_BUS_G(VGA_G),
			.VGA_BUS_B(VGA_B),
			.VGA_HS(VGA_HS),
			.VGA_VS(VGA_VS),
```

```
                .X_pix(X_pix),
                .Y_pix(Y_pix),
                .H_visible(H_visible),
                .V_visible(V_visible),
                .pixel_clk(pixel_clk),
                .pixel_cnt(pixel_cnt)
        );

endmodule
```