Google Dinosaur Game using FPGA

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Abstract— **The Chrome dinosaur game is a simple infinite runner, which sees you jump over cacti, and dodge underneath obstacles. Controls are basic.Single click on Space bar in keyboard is required for dinosaur to jump over obstacles whenever required.**

FPGAs' are most broadly used programmable logic devices. Parallel processing nature of FPGA improves performance for many different applications. FPGAs' are flexible and reusable. They can virtually implement any hardware logic by loading the proper configuration (i.e., programming the FPGA), and its functionality can be changed as many times as needed, even at runtime. FPGAs' support interfacing to connect many peripherals.Playing games on computer desktops gives great experience.Hence it is required to interface monitor with NEXYS 4 DDR board.

Keywords:-Space bar,peripherals,monitor,keyboard,NEXYS4 DDR.

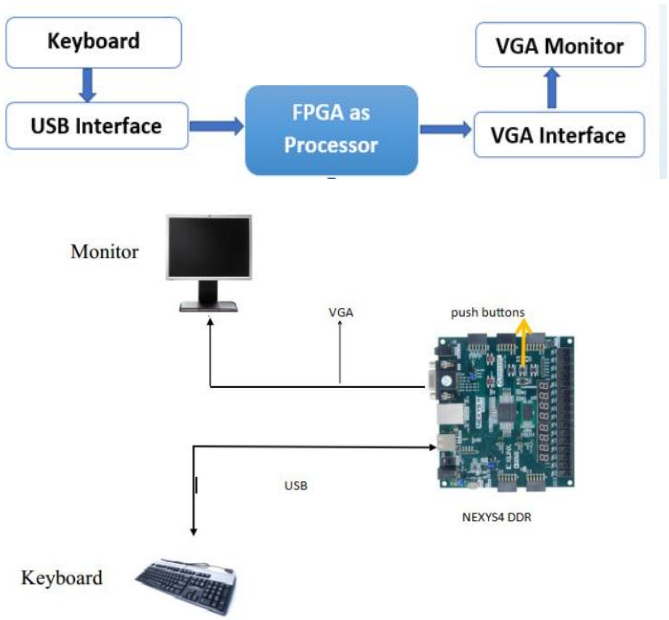
I. INTRODUCTION

Chrome dinosaur is a simple game which require monitor interfacing ,keyboard interfacing by using FPGA board. VGA controller is used to drive monitor.FPGA board is connected to PC monitor via VGA port.We can apply different colors to display objects.FPGAs' support VHDL and Verilog hardware description language.We programmed with Verilog HDL.Carefully catching scan codes generated from keyboard is part of interfacing keyboard with FPGA and use them as per our requirement.We used scan code 29 (scan code for space bar) to jump.Single click on space bar is enough to jump once.Whenever we touched obstacle,we lost the game.Score will be reset.

II. USE OF FPGA

Field Programmable Gate Array [FPGA] technology is becoming more popular among Application Specific Integrated Circuit [ASIC].FPGA compete favourably with GPUs on price/performance and power/performance. FPGAs, are programmable logic devices that can be reconfigured any number of times to perform different tasks.

III. HARDWARE IMPLEMENTATION

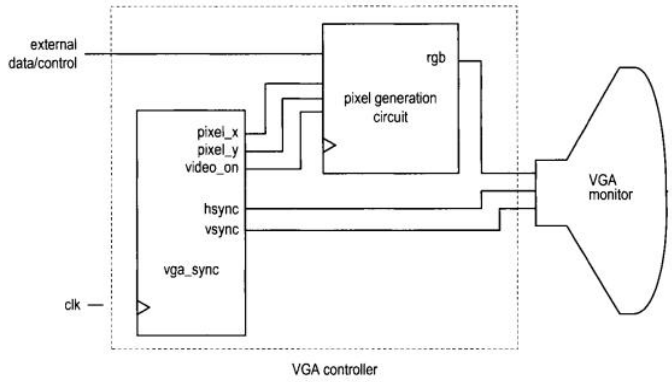


FPGAs are much better than CPUs (or **GPUs**, which have to communicate via the CPU). With an **FPGA** it is feasible to get a latency around or below 1 microsecond, whereas with a CPU latency smaller than 50 microseconds.Hence FPGA-NEXYS 4 DDR is selected as processor which is the heart of the design.

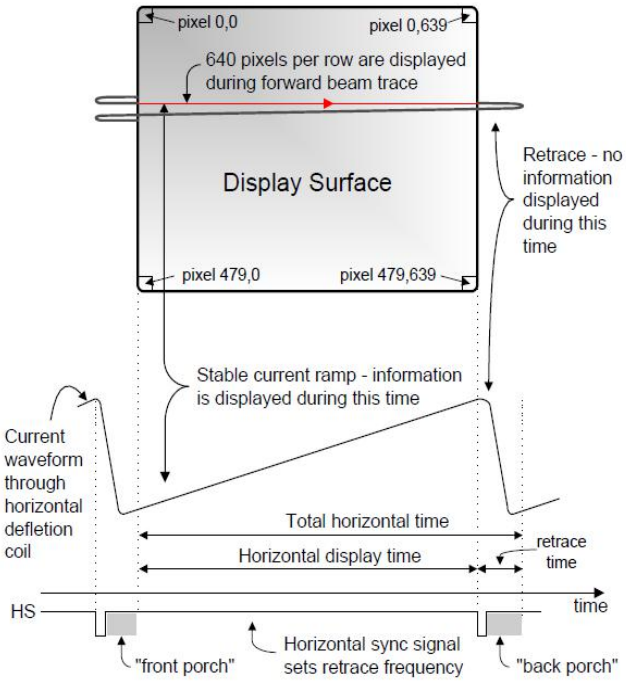
VGA Interface:

VGA(Video Graphics Array) is a video display, widely supported by PC Graphics hardware and monitors. The Nexys4 board uses 14 FPGA signals to create a VGA port with 4 bits-per-color and the two standard sync signals (HS – Horizontal Sync, and VS – Vertical Sync) . A video controller circuit must be created in the FPGA to drive the vga-sync and color signals with the correct timing in order to produce a working display system.

VGA Controller:



Visible portion of Screen on monitor:



Interfacing with Keyboard:

Keyboards use scan codes to communicate with FPGA . Each key is assigned with a code that is sent whenever the key is pressed. A PS2 receiver circuit must be created in the FPGA to process the alpha numeric and symbol keys from the keyboard.When space bar is pressed,dinosaur will jump.

Pixel Generation Circuits:

The pixel generation circuit generates the 3-bit RGB signal for the VGA port. The external control and data signals specify the content of the screen, and the pixel_x (HS) and pixel_y (VS) signals from the vga_sync circuit provide the current coordinates of the pixel. This pixel generation circuit divided into three categories. These are

1) Object mapped scheme.
2) Bit mapped scheme.
3) Tile mapped scheme.

By using these three techniques we display the different objects and different letters on the screen. We used Bit mapping scheme to display objects easily.

IV. GOOGLE DINOSAUR GAME

We have given following colors to different objects.
Obstacles(Cactus) -green color

Dinosaur -yellow

Game over -red

Score -white

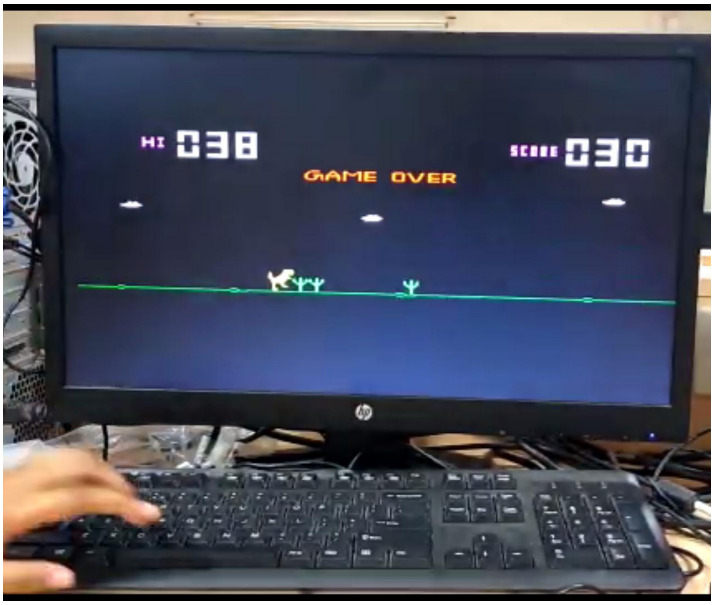
Clouds - white

Background -black

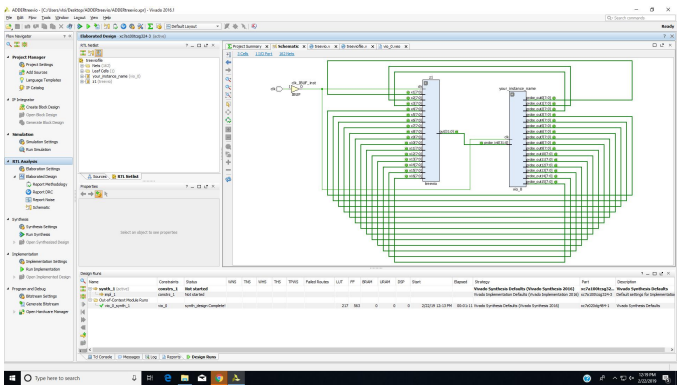
When we press space,dinosaur goes up and down.

Whenever obstacle comes ,we have to press space bar.

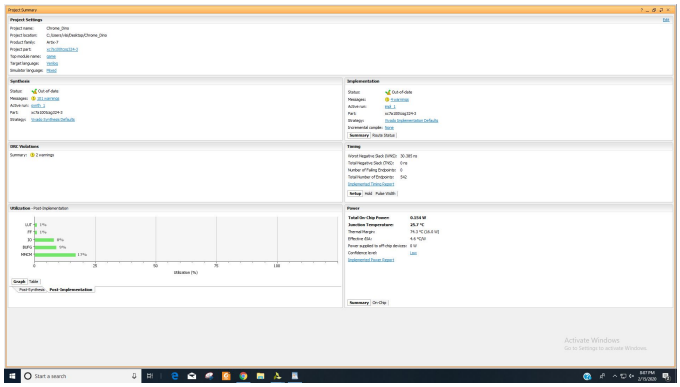
When dinosaur touches cactus,game will be over.



Utilization Report:



Power Report:



Advantages :

1) Bit mapping to display objects decreases code density.
2) Space bar is pressed only once to jump over obstacle.
3) Scorecard display code has in fewer lines .
4) Dinosaur smoothly jumps over obstacles instead of steep jump.

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