

CS210 FPGA PROJECT

Name of Project: Snake & Ladder Game

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Sairam Paila

Vardhan Gacche

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III.DE1-SoC kit

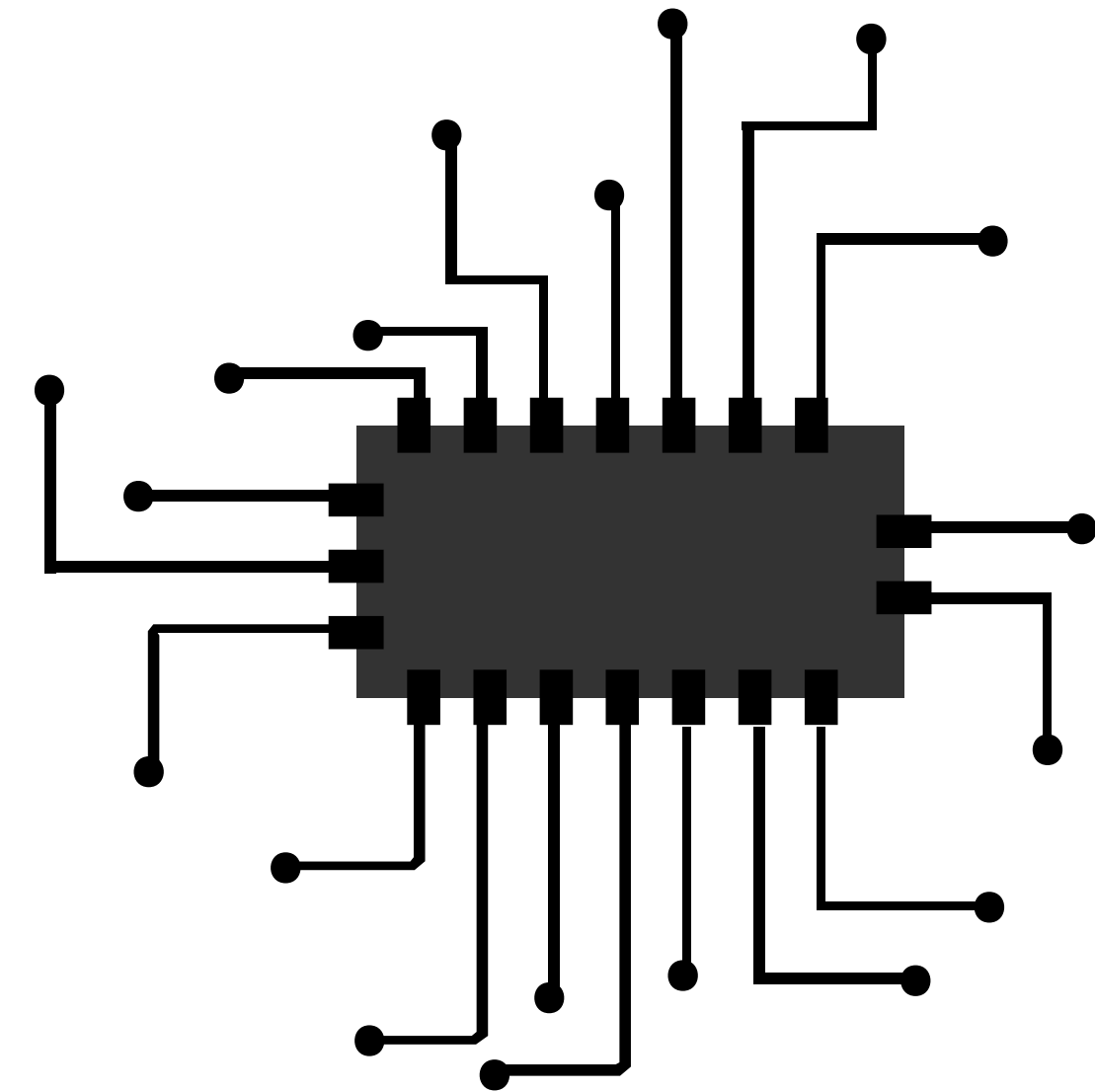
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Project Overview

In this Project, We have implemented game- Snake & Ladder on FPGA . The snake & ladder game is an interactive game connected to the DE1-SoC board. On software ground , we have used C language to program the board and in hardware - user interrupts have been used for the interaction.



Apparatus Required



DE1-SoC Board

it is a microcontroller to control all components used in this project.

JP1 Expansion Ports

The General purpose Input/output port used for connection

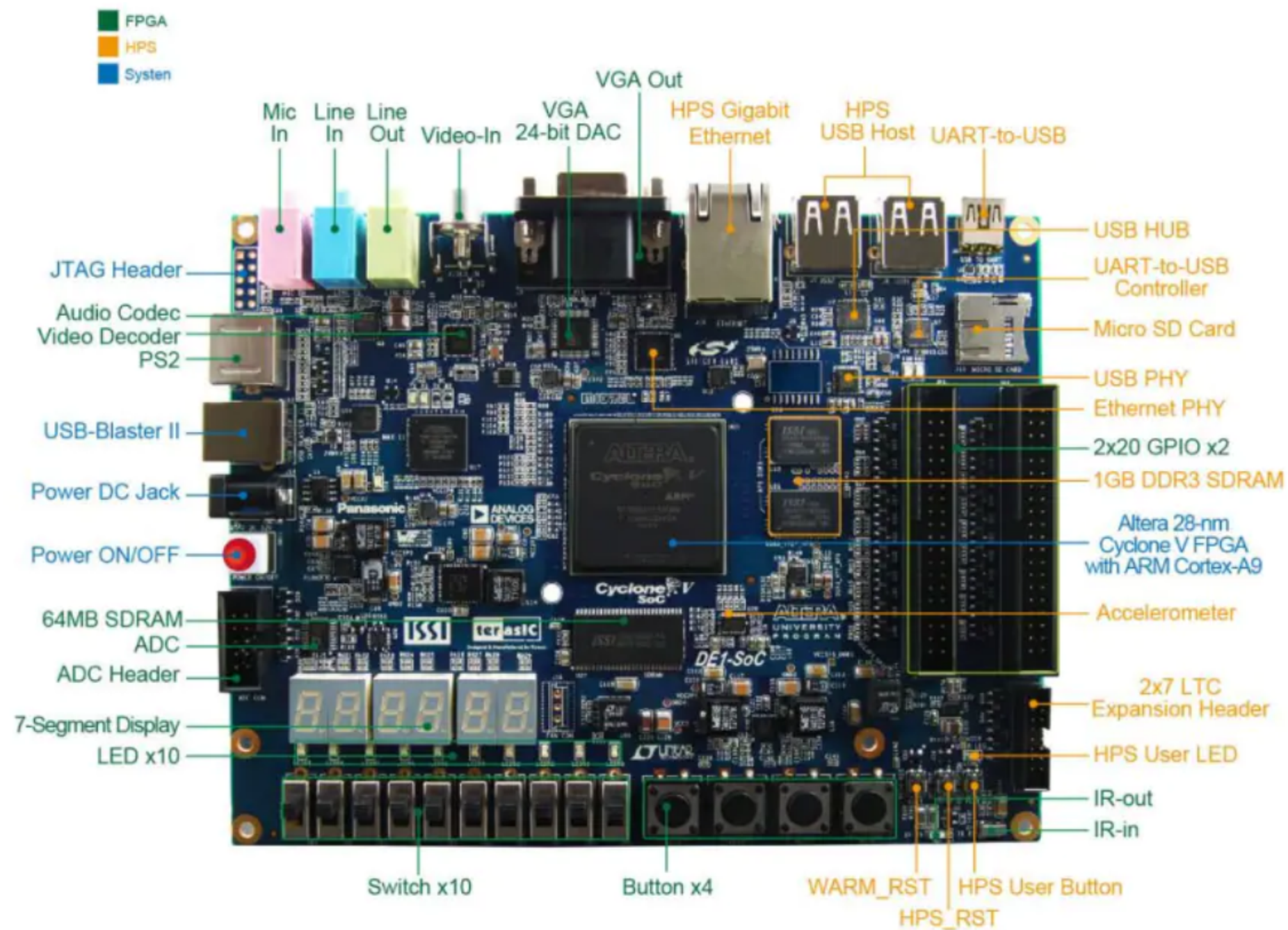
Intel FPGA Monitor Program

The software application to program FPGA board .

Push Buttons

It is used to push buttons for game play and interaction.

DE1-SoC Development Kit



Project Discussion

- The game is played on terminal . Its a " computer vs You" game .L denotes Ladder , S- Snake , O- Player's position, X-Computer's position.
- Each player starts from 0 , on each move player rolls dice and his position moves ahead by dice outcome amount . Player gets an additional move if he rolls a "6", else turns are switched. Whoever reaches 100 first wins.
- The ladder positions are -1, 4, 9, 21, 28, 36, 51, 71, 80 while snake positions are -16, 47, 49, 56, 62, 64, 87, 93, 95, 98.
- After each move , the board is printed afresh on terminal showing current player positions, with dice outcome result message.

Project Discussion

- The functions we have used to implement various functionalities are :- i) printComputerWon() , printPlayerWon()- to display winning art ii) printSpace() , printBoard() , printBox():- to print board at each instance iii) playRoll() , nextMove() , playerTurn() , cpuTurn() , movePlayer() , moveCPU() , rollDice() , init() :- to roll dice so as to generate a random no from 1 to 6 and move positions accordingly iv) config_GIC() , config_HPS_timer() , config_interval_timer() :- configurations for the timers, interrupt service routines, and exceptions.
- To avoid generating repeated dice outcomes , we have initialised random function with seed with time(0).

Images Overview

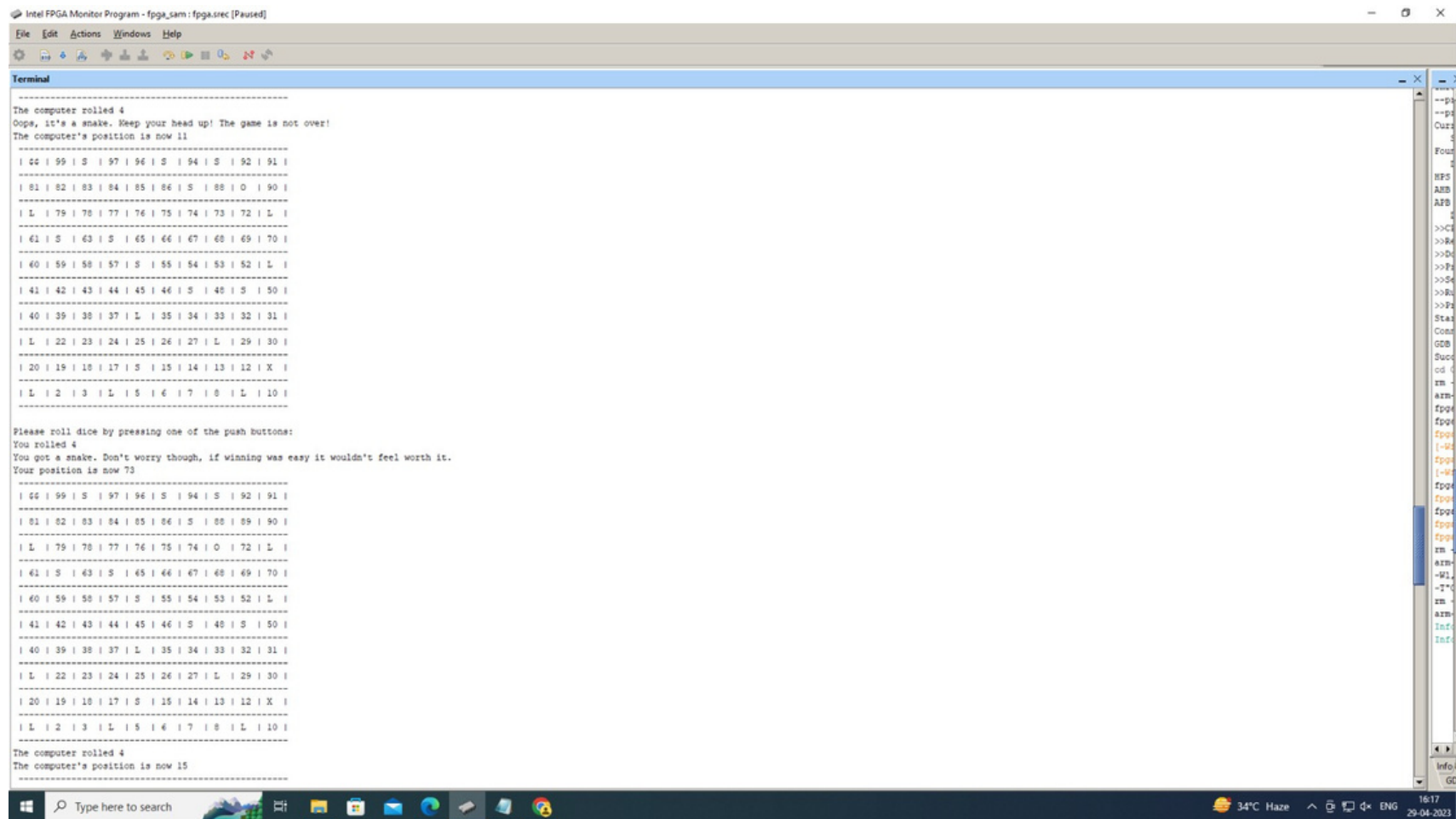
The screenshot shows the Intel FPGA Monitor Program interface. The main window displays a Snake & Ladder game simulation. The game board is a 10x10 grid with numbers 1 to 100. The player's position is 3, and the computer's position is 2. The game is paused. The interface includes a menu bar (File, Edit, Actions, Windows, Help), a toolbar, and a status bar at the bottom showing the system clock and temperature.

```
Intel FPGA Monitor Program - fpga_sam : fpga.rec [Running]
File Edit Actions Windows Help
Terminal
Snake & Ladder game
By : Saiiram,Vikash,Vardhan
What is your name? sam
Hello sam! We're so excited to be with you on this journey. May the best player wins.
Please roll dice by pressing one of the push buttons:
You rolled 3
Your position is now 3
-----
| 44 | 59 | 15 | 97 | 96 | 15 | 94 | 15 | 92 | 91 |
| 81 | 82 | 83 | 84 | 85 | 86 | 15 | 88 | 89 | 90 |
| 15 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 |
| 61 | 15 | 63 | 15 | 65 | 66 | 67 | 68 | 69 | 70 |
| 40 | 59 | 58 | 57 | 15 | 55 | 54 | 53 | 52 | 15 |
| 41 | 42 | 43 | 44 | 45 | 46 | 15 | 48 | 15 | 50 |
| 40 | 39 | 38 | 37 | 15 | 35 | 34 | 33 | 32 | 31 |
| 15 | 22 | 23 | 24 | 25 | 26 | 27 | 15 | 29 | 30 |
| 20 | 19 | 18 | 17 | 15 | 15 | 14 | 13 | 12 | 11 |
| 15 | 2 | 10 | 15 | 16 | 17 | 18 | 15 | 10 |
-----
The computer rolled 2
The computer's position is now 2
-----
| 44 | 59 | 15 | 97 | 96 | 15 | 94 | 15 | 92 | 91 |
| 81 | 82 | 83 | 84 | 85 | 86 | 15 | 88 | 89 | 90 |
| 15 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 |
| 61 | 15 | 63 | 15 | 65 | 66 | 67 | 68 | 69 | 70 |
| 40 | 59 | 58 | 57 | 15 | 55 | 54 | 53 | 52 | 15 |
| 41 | 42 | 43 | 44 | 45 | 46 | 15 | 48 | 15 | 50 |
| 40 | 39 | 38 | 37 | 15 | 35 | 34 | 33 | 32 | 31 |
| 15 | 22 | 23 | 24 | 25 | 26 | 27 | 15 | 29 | 30 |
| 20 | 19 | 18 | 17 | 15 | 15 | 14 | 13 | 12 | 11 |
| 15 | X | 10 | 15 | 16 | 17 | 18 | 15 | 10 |
-----
Info & Errors
INFO: Non-memory - Slider_Switches 0x00000040
INFO: Non-memory - PushButtons 0x00000050
INFO: Non-memory - Expansion_TPI 0x00000060
INFO: Non-memory - Expansion_TPI2 0x00000070
INFO: Non-memory - Interval_Timer 0x00000080
INFO: Non-memory - Interval_Timer_2 0x00000090
INFO: Non-memory - Pixel_DMA_Addr_Translation 0x000000A0
INFO: Non-memory - Char_DMA_Addr_Translation 0x000000B0
INFO: Non-memory - Video_In_DMA_Addr_Translation 0x000000C0
INFO: Non-memory - Video_In_Subsystem_Video_In_Edge_Detection 0x000000D0
INFO: Non-memory - ARM_A9_RFS_arm_gic_0 0x000000E0
INFO: Non-memory - ARM_A9_RFS_arm_gic_1 0x000000F0
INFO: Non-memory - ARM_A9_RFS_12 0x00000100
INFO: Non-memory - ARM_A9_RFS_dma 0x00000110
INFO: Non-memory - ARM_A9_RFS_smpmgr 0x00000120
INFO: Non-memory - ARM_A9_RFS_clmgr 0x00000130
INFO: Non-memory - ARM_A9_RFS_rtmgr 0x00000140
INFO: Non-memory - ARM_A9_RFS_fpgaimg 0x00000150
INFO: Non-memory - ARM_A9_RFS_fpgaimg 0x00000160
INFO: Non-memory - ARM_A9_RFS_uart0 0x00000170
INFO: Non-memory - ARM_A9_RFS_uart1 0x00000180
INFO: Non-memory - ARM_A9_RFS_timer0 0x00000190
INFO: Non-memory - ARM_A9_RFS_timer1 0x000001A0
INFO: Non-memory - ARM_A9_RFS_timer2 0x000001B0
INFO: Non-memory - ARM_A9_RFS_timer3 0x000001C0
INFO: Non-memory - ARM_A9_RFS_wd_timer0 0x000001D0
INFO: Non-memory - ARM_A9_RFS_wd_timer1 0x000001E0
INFO: Non-memory - ARM_A9_RFS_gp100 0x000001F0
INFO: Non-memory - ARM_A9_RFS_gp101 0x00000200
INFO: Non-memory - ARM_A9_RFS_gp102 0x00000210
INFO: Non-memory - ARM_A9_RFS_12c0 0x00000220
INFO: Non-memory - ARM_A9_RFS_12c1 0x00000230
INFO: Non-memory - ARM_A9_RFS_12c2 0x00000240
INFO: Non-memory - ARM_A9_RFS_12c3 0x00000250
INFO: Non-memory - ARM_A9_RFS_pand0 0x00000260
INFO: Non-memory - ARM_A9_RFS_pand0 0x00000270
INFO: Non-memory - ARM_A9_RFS_spm0 0x00000280
INFO: Non-memory - ARM_A9_RFS_spm1 0x00000290
INFO: Non-memory - ARM_A9_RFS_gpi 0x000002A0
INFO: Non-memory - ARM_A9_RFS_smmc 0x000002B0
INFO: Non-memory - ARM_A9_RFS_usb0 0x000002C0
INFO: Non-memory - ARM_A9_RFS_usb1 0x000002D0
INFO: Non-memory - ARM_A9_RFS_gmac0 0x000002E0
INFO: Non-memory - ARM_A9_RFS_gmac1 0x000002F0
INFO: Non-memory - ARM_A9_RFS_scan0 0x00000300
INFO: Non-memory - ARM_A9_RFS_scan1 0x00000310
INFO: Non-memory - ARM_A9_RFS_11nps 0x00000320
INFO: Non-memory - ARM_A9_RFS_sdcctl 0x00000330
INFO: Non-memory - ARM_A9_RFS_timer 0x00000340
INFO: Non-memory - ARM_A9_RFS_sou 0x00000350
```

The screenshot shows the Intel FPGA Monitor Program interface. The main window displays a Snake & Ladder game simulation. The game board is a 10x10 grid with numbers 1 to 100. The player's position is 3, and the computer's position is 2. The game is paused. The interface includes a menu bar (File, Edit, Actions, Windows, Help), a toolbar, and a status bar at the bottom showing the system clock and temperature.

```
Intel FPGA Monitor Program - fpga_sam : fpga.rec [Paused]
File Edit Actions Windows Help
Terminal
-----
| 15 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 15 | 10 |
-----
The computer rolled 2
The computer's position is now 17
-----
| 44 | 59 | 15 | 97 | 96 | 15 | 94 | 15 | 92 | 91 |
| 81 | 82 | 83 | 84 | 85 | 86 | 15 | 88 | 89 | 90 |
| 15 | 79 | 78 | 77 | 10 | 75 | 74 | 73 | 72 | 71 |
| 41 | 15 | 43 | 15 | 45 | 46 | 47 | 48 | 49 | 70 |
| 40 | 59 | 58 | 57 | 15 | 55 | 54 | 53 | 52 | 15 |
| 41 | 42 | 43 | 44 | 45 | 46 | 15 | 48 | 15 | 50 |
| 40 | 39 | 38 | 37 | 15 | 35 | 34 | 33 | 32 | 31 |
| 15 | 22 | 23 | 24 | 25 | 26 | 27 | 15 | 29 | 30 |
| 15 | 2 | 13 | 15 | 16 | 17 | 18 | 15 | 10 |
-----
Please roll dice by pressing one of the push buttons:
You rolled 4
THE JACKPOT!!! CONGRATULATIONS! You've landed on ladder to the finish line!!!
Your position is now 100
-----
| 44 | 59 | 15 | 97 | 96 | 15 | 94 | 15 | 92 | 91 |
| 81 | 82 | 83 | 84 | 85 | 86 | 15 | 88 | 89 | 90 |
| 15 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 |
| 41 | 15 | 43 | 15 | 45 | 46 | 47 | 48 | 49 | 70 |
| 40 | 59 | 58 | 57 | 15 | 55 | 54 | 53 | 52 | 15 |
| 41 | 42 | 43 | 44 | 45 | 46 | 15 | 48 | 15 | 50 |
| 40 | 39 | 38 | 37 | 15 | 35 | 34 | 33 | 32 | 31 |
| 15 | 22 | 23 | 24 | 25 | 26 | 27 | 15 | 29 | 30 |
| 20 | 19 | 18 | 17 | 15 | 15 | 14 | 13 | 12 | 11 |
| 15 | 2 | 13 | 15 | 16 | 17 | 18 | 15 | 10 |
-----
The computer rolled 2
The computer's position is now 19
-----
| 44 | 59 | 15 | 97 | 96 | 15 | 94 | 15 | 92 | 91 |
| 81 | 82 | 83 | 84 | 85 | 86 | 15 | 88 | 89 | 90 |
| 15 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 |
| 41 | 15 | 43 | 15 | 45 | 46 | 47 | 48 | 49 | 70 |
| 40 | 59 | 58 | 57 | 15 | 55 | 54 | 53 | 52 | 15 |
| 41 | 42 | 43 | 44 | 45 | 46 | 15 | 48 | 15 | 50 |
| 40 | 39 | 38 | 37 | 15 | 35 | 34 | 33 | 32 | 31 |
| 15 | 22 | 23 | 24 | 25 | 26 | 27 | 15 | 29 | 30 |
| 20 | 19 | 18 | 17 | 15 | 15 | 14 | 13 | 12 | 11 |
| 15 | 2 | 13 | 15 | 16 | 17 | 18 | 15 | 10 |
-----
Info & Errors
INFO: Non-memory - Slider_Switches 0x00000040
INFO: Non-memory - PushButtons 0x00000050
INFO: Non-memory - Expansion_TPI 0x00000060
INFO: Non-memory - Expansion_TPI2 0x00000070
INFO: Non-memory - Interval_Timer 0x00000080
INFO: Non-memory - Interval_Timer_2 0x00000090
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INFO: Non-memory - Char_DMA_Addr_Translation 0x000000B0
INFO: Non-memory - Video_In_DMA_Addr_Translation 0x000000C0
INFO: Non-memory - Video_In_Subsystem_Video_In_Edge_Detection 0x000000D0
INFO: Non-memory - ARM_A9_RFS_arm_gic_0 0x000000E0
INFO: Non-memory - ARM_A9_RFS_arm_gic_1 0x000000F0
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INFO: Non-memory - ARM_A9_RFS_dma 0x00000110
INFO: Non-memory - ARM_A9_RFS_smpmgr 0x00000120
INFO: Non-memory - ARM_A9_RFS_clmgr 0x00000130
INFO: Non-memory - ARM_A9_RFS_rtmgr 0x00000140
INFO: Non-memory - ARM_A9_RFS_fpgaimg 0x00000150
INFO: Non-memory - ARM_A9_RFS_fpgaimg 0x00000160
INFO: Non-memory - ARM_A9_RFS_uart0 0x00000170
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INFO: Non-memory - ARM_A9_RFS_12c1 0x00000230
INFO: Non-memory - ARM_A9_RFS_12c2 0x00000240
INFO: Non-memory - ARM_A9_RFS_12c3 0x00000250
INFO: Non-memory - ARM_A9_RFS_pand0 0x00000260
INFO: Non-memory - ARM_A9_RFS_pand0 0x00000270
INFO: Non-memory - ARM_A9_RFS_spm0 0x00000280
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INFO: Non-memory - ARM_A9_RFS_gpi 0x000002A0
INFO: Non-memory - ARM_A9_RFS_smmc 0x000002B0
INFO: Non-memory - ARM_A9_RFS_usb0 0x000002C0
INFO: Non-memory - ARM_A9_RFS_usb1 0x000002D0
INFO: Non-memory - ARM_A9_RFS_gmac0 0x000002E0
INFO: Non-memory - ARM_A9_RFS_gmac1 0x000002F0
INFO: Non-memory - ARM_A9_RFS_scan0 0x00000300
INFO: Non-memory - ARM_A9_RFS_scan1 0x00000310
INFO: Non-memory - ARM_A9_RFS_11nps 0x00000320
INFO: Non-memory - ARM_A9_RFS_sdcctl 0x00000330
INFO: Non-memory - ARM_A9_RFS_timer 0x00000340
INFO: Non-memory - ARM_A9_RFS_sou 0x00000350
```


Images Overview



Intel FPGA Monitor Program - fpga_sam : fpga.srec [Paused]

File Edit Actions Windows Help

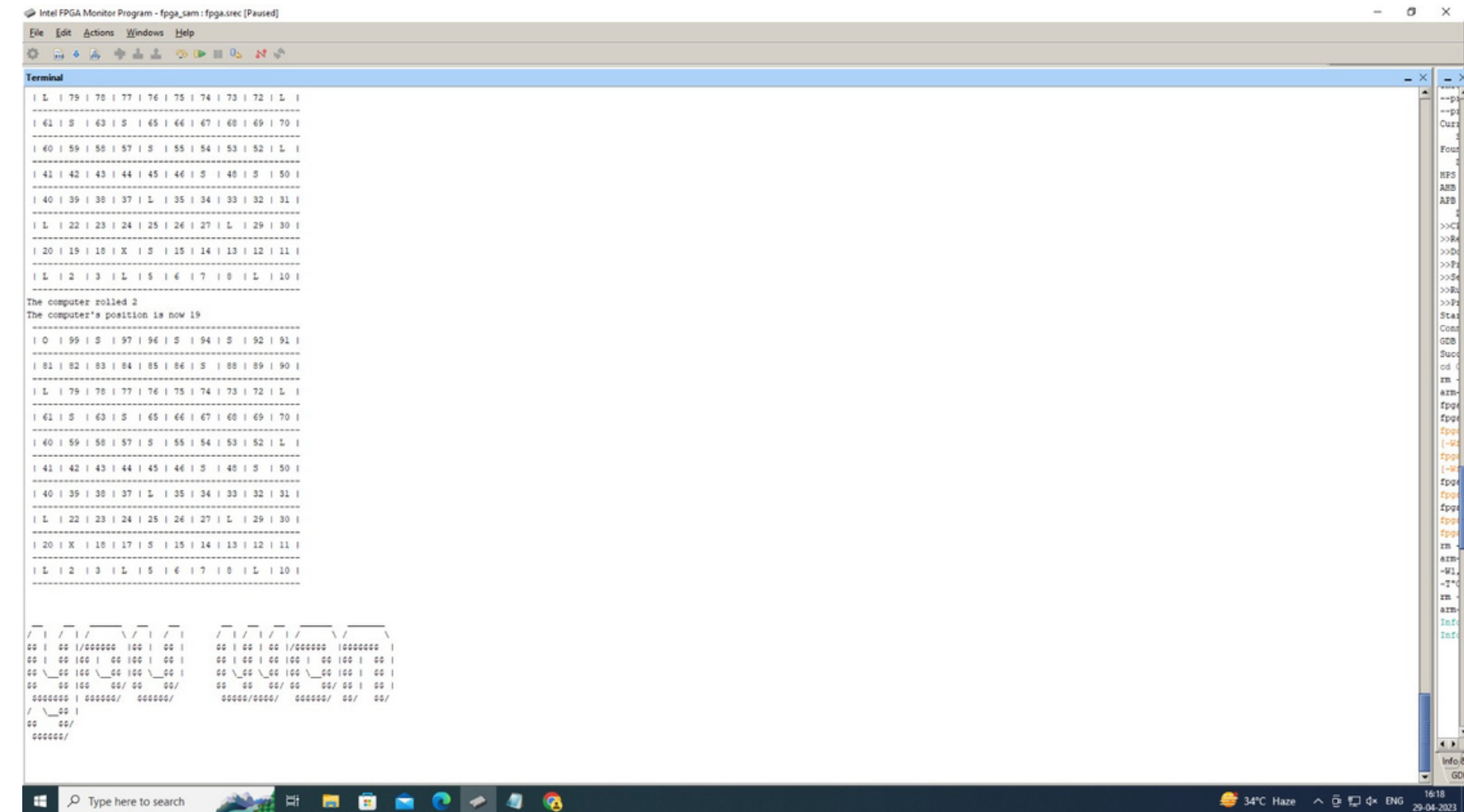
Terminal

```
-----
The computer rolled 4
Oops, it's a snake. Keep your head up! The game is not over!
The computer's position is now 11
-----
| 00 | 99 | 5 | 97 | 96 | 5 | 94 | 5 | 92 | 91 |
-----
| 81 | 82 | 83 | 84 | 85 | 86 | 5 | 88 | 89 | 90 |
-----
| 1 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 1 |
-----
| 61 | 5 | 63 | 5 | 65 | 66 | 67 | 68 | 69 | 70 |
-----
| 40 | 59 | 58 | 57 | 5 | 55 | 54 | 53 | 52 | 1 |
-----
| 41 | 42 | 43 | 44 | 45 | 46 | 5 | 48 | 5 | 50 |
-----
| 40 | 59 | 38 | 37 | 1 | 35 | 34 | 33 | 32 | 31 |
-----
| 1 | 22 | 23 | 24 | 25 | 26 | 27 | 1 | 29 | 30 |
-----
| 20 | 19 | 18 | 17 | 5 | 15 | 14 | 13 | 12 | 11 |
-----
| 1 | 2 | 3 | 1 | 5 | 6 | 7 | 8 | 1 | 10 |
-----

Please roll dice by pressing one of the push buttons:
You rolled 4
You got a snake. Don't worry though, if winning was easy it wouldn't feel worth it.
Your position is now 73
-----
| 00 | 99 | 5 | 97 | 96 | 5 | 94 | 5 | 92 | 91 |
-----
| 81 | 82 | 83 | 84 | 85 | 86 | 5 | 88 | 89 | 90 |
-----
| 1 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 1 |
-----
| 61 | 5 | 63 | 5 | 65 | 66 | 67 | 68 | 69 | 70 |
-----
| 40 | 59 | 58 | 57 | 5 | 55 | 54 | 53 | 52 | 1 |
-----
| 41 | 42 | 43 | 44 | 45 | 46 | 5 | 48 | 5 | 50 |
-----
| 40 | 59 | 38 | 37 | 1 | 35 | 34 | 33 | 32 | 31 |
-----
| 1 | 22 | 23 | 24 | 25 | 26 | 27 | 1 | 29 | 30 |
-----
| 20 | 19 | 18 | 17 | 5 | 15 | 14 | 13 | 12 | 11 |
-----
| 1 | 2 | 3 | 1 | 5 | 6 | 7 | 8 | 1 | 10 |
-----

The computer rolled 4
The computer's position is now 15
-----
```

16:17 29-04-2023



Intel FPGA Monitor Program - fpga_sam : fpga.srec [Paused]

File Edit Actions Windows Help

Terminal

```
-----
| 1 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 1 |
-----
| 61 | 5 | 63 | 5 | 65 | 66 | 67 | 68 | 69 | 70 |
-----
| 40 | 59 | 58 | 57 | 5 | 55 | 54 | 53 | 52 | 1 |
-----
| 41 | 42 | 43 | 44 | 45 | 46 | 5 | 48 | 5 | 50 |
-----
| 40 | 59 | 38 | 37 | 1 | 35 | 34 | 33 | 32 | 31 |
-----
| 1 | 22 | 23 | 24 | 25 | 26 | 27 | 1 | 29 | 30 |
-----
| 20 | 19 | 18 | 17 | 11 | 15 | 14 | 13 | 12 | 11 |
-----
| 1 | 2 | 3 | 1 | 5 | 6 | 7 | 8 | 1 | 10 |
-----

The computer rolled 2
The computer's position is now 19
-----
| 0 | 99 | 5 | 97 | 96 | 5 | 94 | 5 | 92 | 91 |
-----
| 81 | 82 | 83 | 84 | 85 | 86 | 5 | 88 | 89 | 90 |
-----
| 1 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 1 |
-----
| 61 | 5 | 63 | 5 | 65 | 66 | 67 | 68 | 69 | 70 |
-----
| 40 | 59 | 58 | 57 | 5 | 55 | 54 | 53 | 52 | 1 |
-----
| 41 | 42 | 43 | 44 | 45 | 46 | 5 | 48 | 5 | 50 |
-----
| 40 | 59 | 38 | 37 | 1 | 35 | 34 | 33 | 32 | 31 |
-----
| 1 | 22 | 23 | 24 | 25 | 26 | 27 | 1 | 29 | 30 |
-----
| 20 | 19 | 18 | 17 | 5 | 15 | 14 | 13 | 12 | 11 |
-----
| 1 | 2 | 3 | 1 | 5 | 6 | 7 | 8 | 1 | 10 |
-----

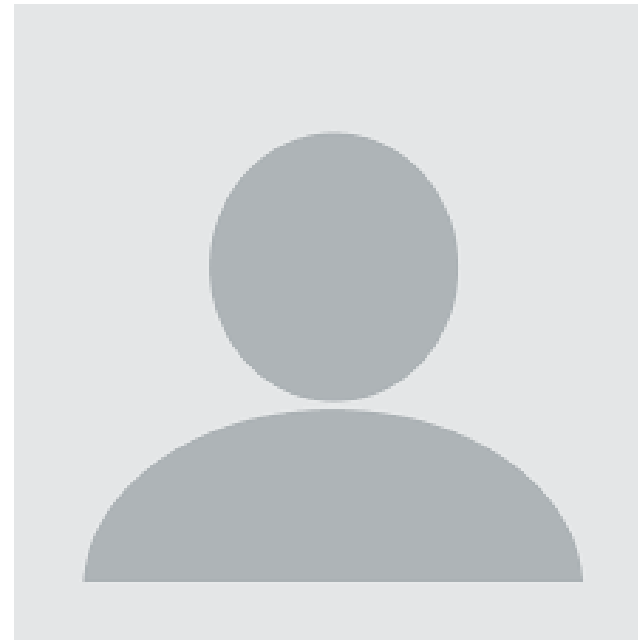
-----
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
-----
| 00 | 00 | 000000 | 00 | 00 | 00 | 00 | 000000 | 00000000 |
-----
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
-----
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
-----
| 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
-----
| 000000 | 000000 | 000000 | 000000 | 000000 | 000000 |
-----
| 00 | 00 |
-----
| 000000 |
-----
```

16:18 29-04-2023

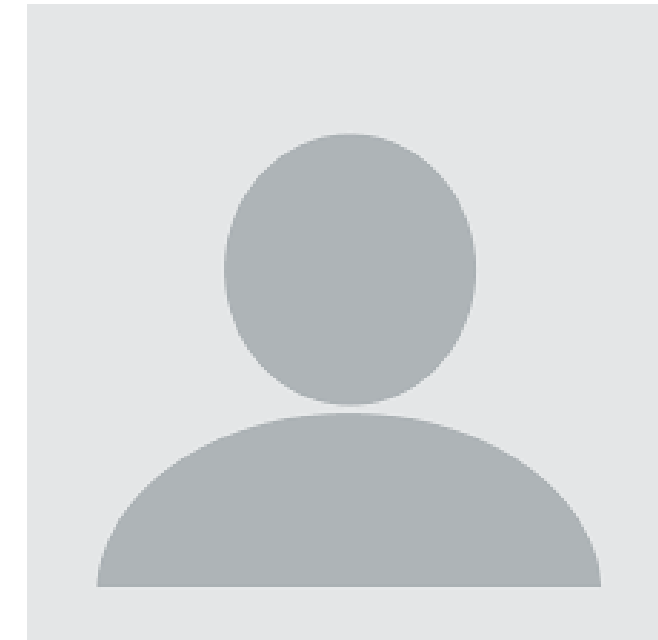
Our Team



Sairam Paila
Roll no- 2101CS70



Vardhan Gacche
Roll no- 2101CS80



Vikash Kumar Verma
Roll no- 2101CS82



THANK YOU

