Lab Assignment

Report 8

Part 2

Course: COL215 – Digital Logic & System Design

Department of Computer Science & Engineering, IIT Delhi

Semester III, 2025-26

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Introduction:

In this assignment we added motion to the car with collision detection logic and implemented the FSM consisting of states such as LEFT_CAR, RIGHT_CAR, COLLIDE , START, IDLE to control.

- Design decisions:

FSM-

Input- clk , wire collision, btnC, bntL, btnR.

Output- reg [1:0] car_move .

States- LEFT_CAR(010) , RIGHT_CAR(011), START(000), IDLE(001), COLLIDE(100).

On every clock cycle we are analyzing the input and determining the next state combinationaly and passing it to current state on next clock cycle sequentially, the output of the fsm is car_move which is set accordingly depending upon the input (btnL,btnR,btnC) to update the car_x outside the fsm which will be used for collision detection outside our fsm module which then be taken as input via collision flag resulting in the fsm taking COLLIDE state and bringing the system to complete standstill.

Control Logic-

We are using a move_counter of 22 bits to make the turning of car steady and controlable , the counter increments on every clock cycle when either btnL or btnR is pressed and once it overflows it changes the car_x accordingly.

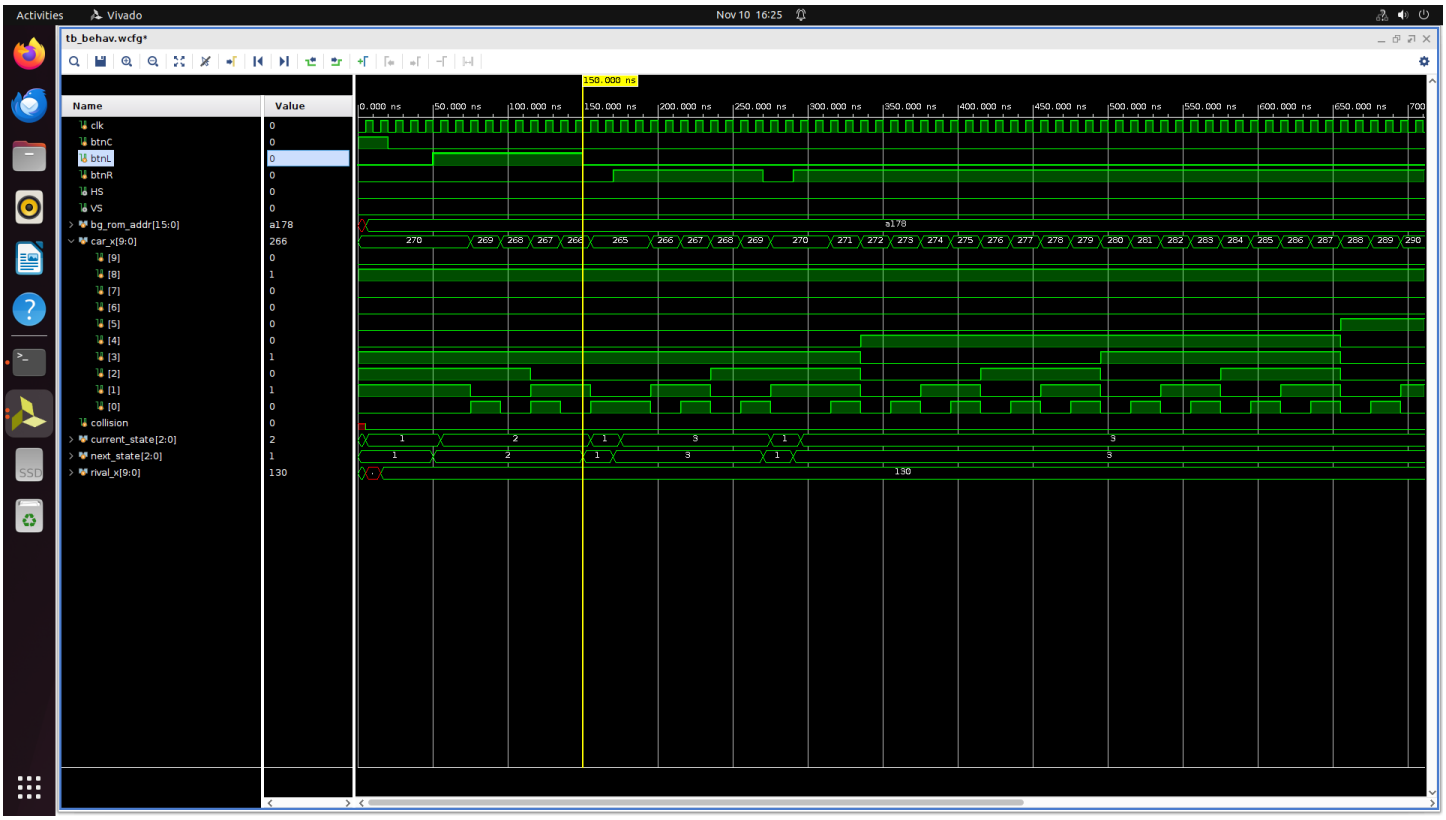
Collision detection is done by checking the intersection of car's hitbox with the road boundaries.

Adding motion-

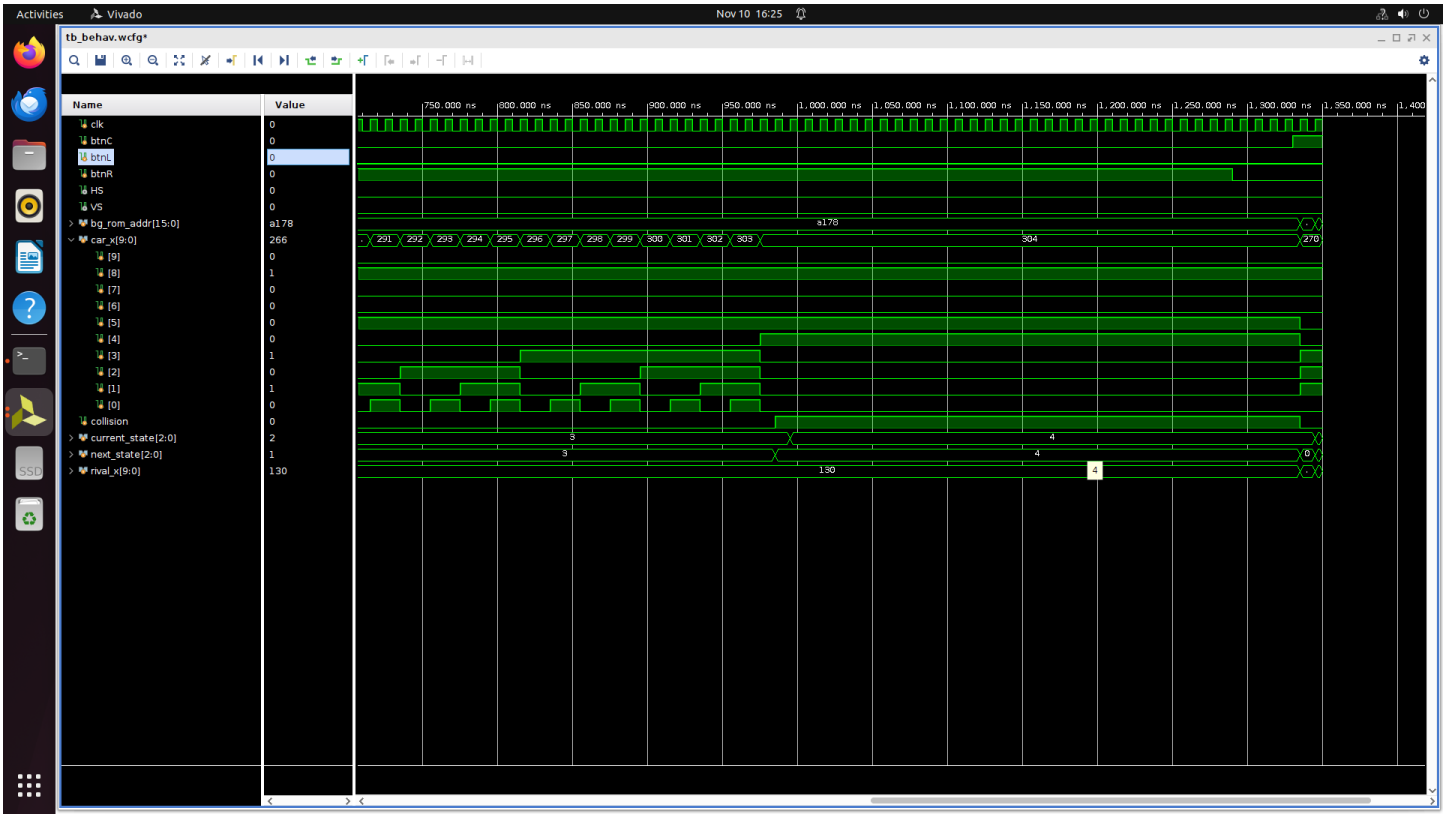
We are maintaining two counters scroll and bg_y and a local parameter MOVE_COUNT_MAX which are used to make the road look moving.

Each time scroll becomes equal to MOVE_COUNT_MAX , bg_y is incremented by one which decides by how much amount the new background image needed to be shift downwards in order to make it look moving. Once bg_y becomes equal to bg1_height we make it 0 again.

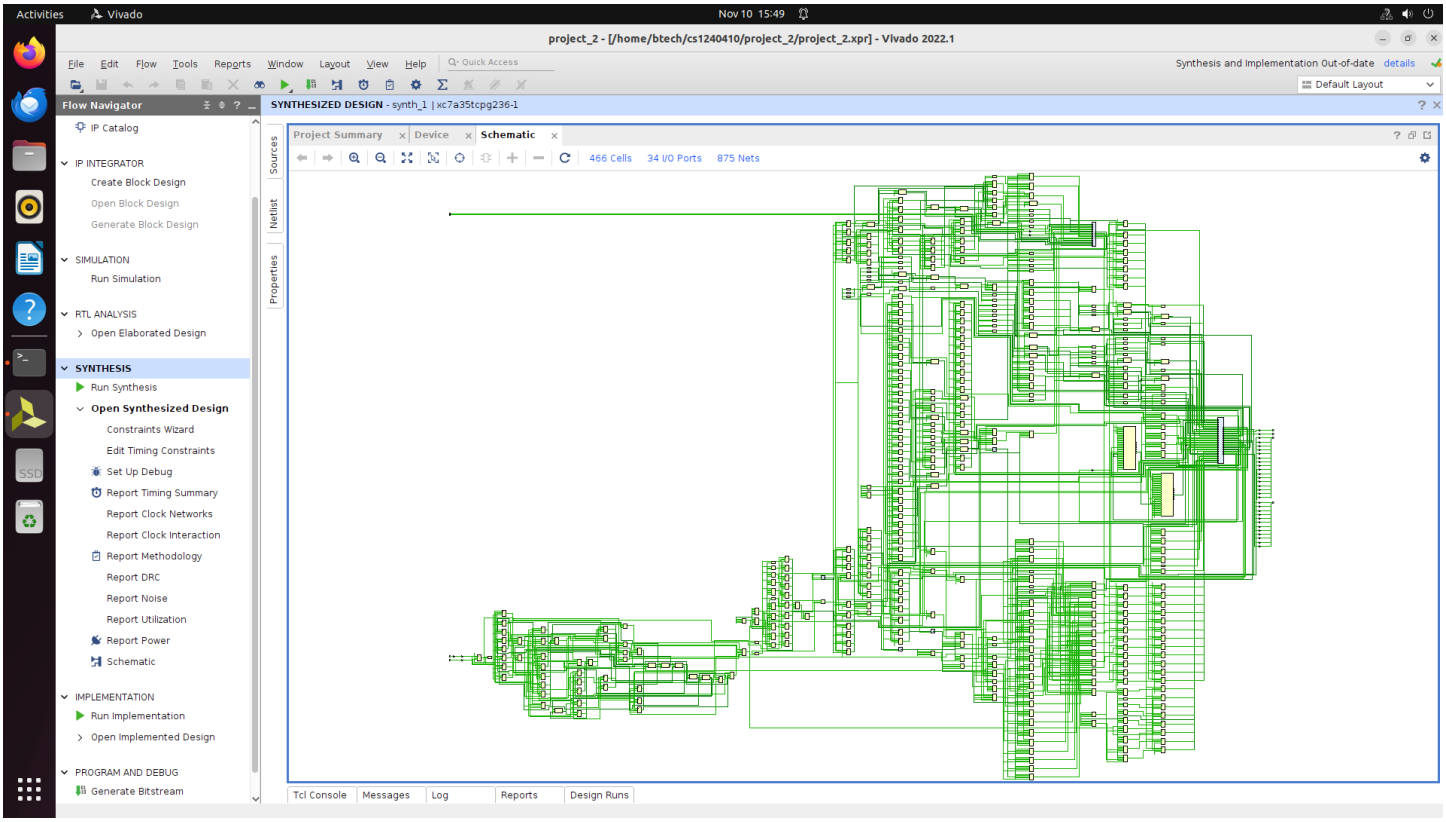
- **Simulation Snapshots:**



Car_x is decreasing then increasing . current_state is in decimal form therefore 1 means idle,2 means left,3 means right and 4 for collision. In the second image, when car_x reaches 304 the collsion flag become active and current_state is set to 4. Then after some time btnC is pressed which reinitializes all the values to default.



Generated Schematics:



Synthesis Report:

Resource	Used	Available	Utilization (%)
LUTs	960	20,800	4.62%
Flip-Flops (FFs)	211	41,600	0.51%
BRAMs	0	50	0.00%
DSPs	2	90	2.22 %