
**Benha University**

# Smart Car Garage Using Verilog


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# Project Objective

- Most of the time, the car garage is full, and the absence of evidence of that makes things sometimes worse. Therefore, the aim of the project is to help eliminate congestion .The detailed Specification of CAR SYSTEM is as follow:

- there's a button to open and close garage
- threre is a counter that increment when car enter garage and decrement when car leave garage
- the maximum number of cars can enter garage is 50
- if the existing cars greater than 50 then garage will not open and display GARAGE IS Full (F) otherwise car enter garage
- when garage not empty a message will appear that the GARAGE IS AVAILABLE (A)otherwise GARAGE IS EMPTY

# *Table of inputs && outputs*

| | | |
|---|---|---|
| *input* | *Pb_up* | *Increament when car enter garage* |
| *input* | *Pb_down* | *decrement when car enter garage* |
| *input* | *Reset* | *Open or close garage* |
| *output* | *1_st seven segment* | *Display The ones digit place* |
| *output* | *2_nd seven segment* | *Display The tens digit place* |
| *output* | *3_th seven segment* | *Display The empty or full or* AVAILABLE *place* |
| *output* | *state* | *Display current state in binary* |

- *How it works ?*

*Car garage system is a group of submodules.*

1. *Module clock_gen*
    - *Outputs clk for clock divider.*
2. *Module clock_div*
    - *Takes Input clk from clk generator .*
    - *Takes Input reset.*
    - *Outputs slowed_clk for clock divider.*
3. *Module FF*

   *Takes input slowed_clock from clock divider and*
    - *Takes input push button_up.*
    - *Takes input push button_down.*
    - *Outputs Debounced_push button_up from flip flop.*
    - *Outputs Debounced_push button_down from flip flop.*
4. *Module BCD_Counter*

   *Takes input Debounced_push button_down.*
   *Takes input Debounced_push button_up*
   *Takes input reset.*
   *Output number of cars at garage.*
   *Output current state .*

5. *Module seg_1e*
    - *Takes reminder 10 of number of cars in binary.*
    - *Display The ones digit place.*
6. *Module seg_2*

   *Takes number of cars division by 10 in binary.*
   *Display The Tens digit place.*

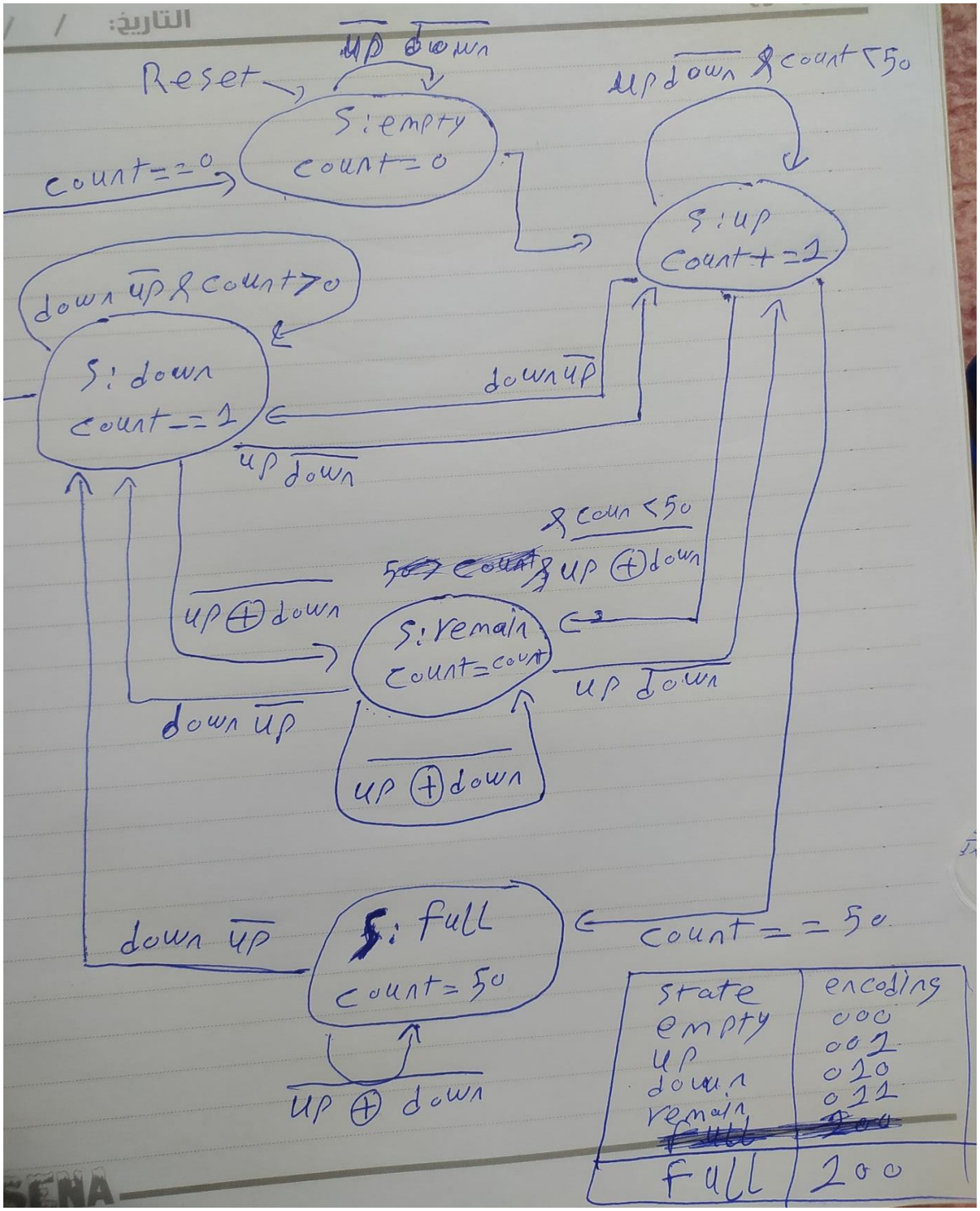
7. *Module flag_seg*
   *Takes number of cars at garage .*
   *Output flag ( F) if number of cars in garage = 50.*
   *Output flag ( E) if number of cars in garage = 0.*
   *Output flag ( A) if*
   *0< number of cars in garage <50.*

- *FSM*

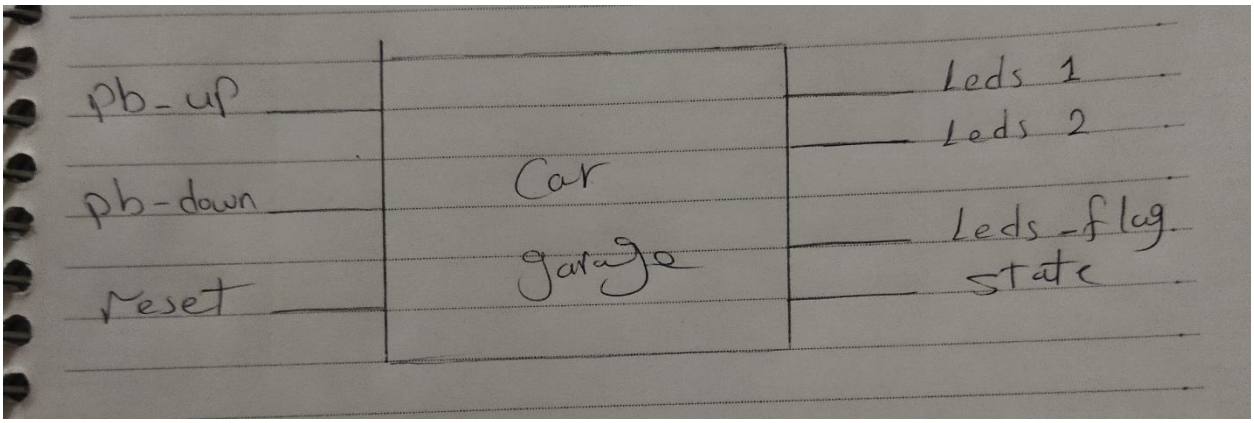
- *State encoding*

| | |
|---|---|
| *empty* | *3'b000* |
| *up* | *3'b001* |
| *down* | *3'b010* |
| *remain* | *3'b011* |
| *full* | *3'b100* |

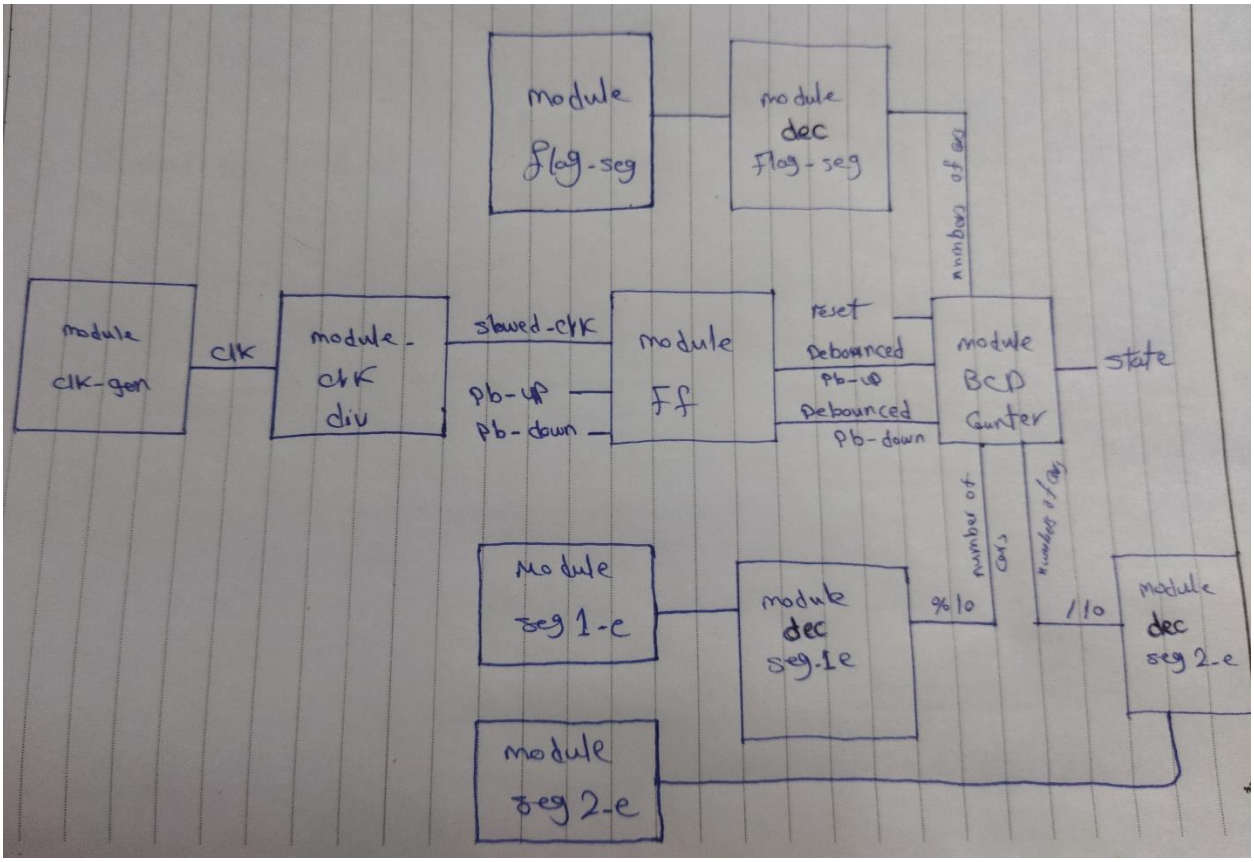
- *FSM diagram*


Reset
S: empty
count=0
count==0
up ⊕ down
up down & count<50
S: up
Count+=1
down up & count>0
S: down
count-=1
down up
up down
& count<50
50> count & up ⊕ down
up ⊕ down
S: remain
count=count
up down
down up
up ⊕ down
down up
S: full
count=50
count==50
up ⊕ down
state
empty
up
down
remain
full
encoding
000
001
010
011
100

## *Gar garage icon*




- *Car garage structure*



- *Results test strategy.*

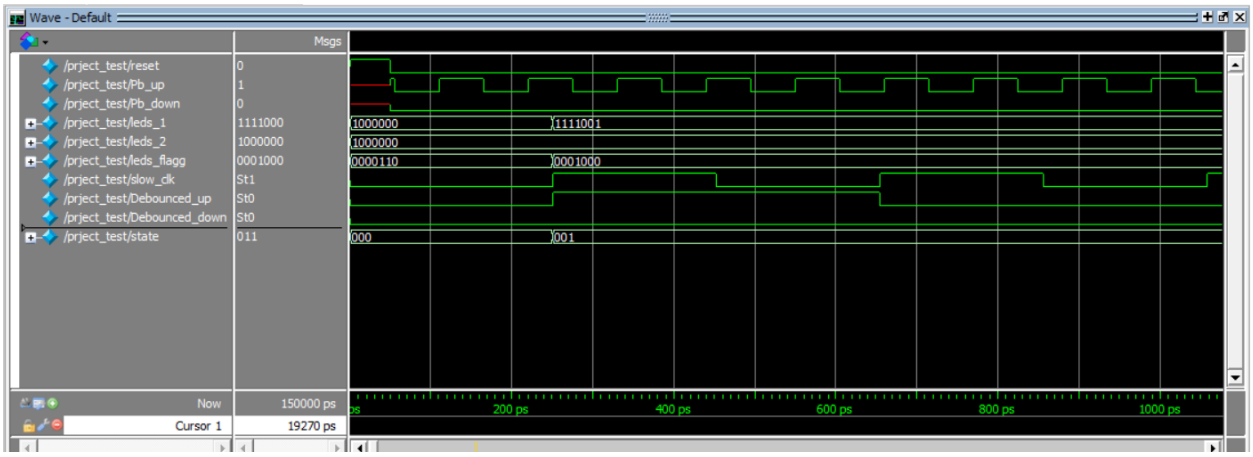
```
{
 initial
    begin
     reset=1 ; #50;
     reset =0;
     Pb_up=1;
     Pb_down=0;
    end
    always
    begin
    #55  Pb_up <= ~Pb_up ;
     end
      always
    begin
    #9446 Pb_down <= ~Pb_down ;
     End.
}
```

*First pb-up was pressed then released .*
*At first 50ps garage was reset then garage is open till the end.*
*Every 50 Ps pb-up was inverted to his current state.*

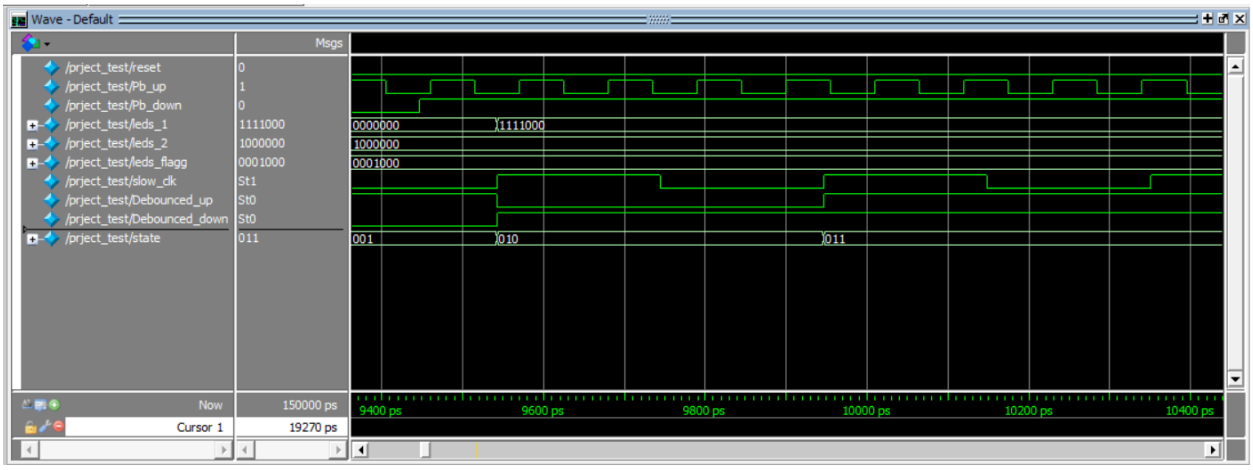
*Every 9446 Ps pb_down was inverted his current state.*

- *Results output example.*

  - *At first garage was closed and number of cars is 0 and flag 7_seg display empty (E).*
  - *When car entered garage the number of cars increment by 1 && flag 7_segment Display (A)Available .*
  - *State was empty then become "up".*

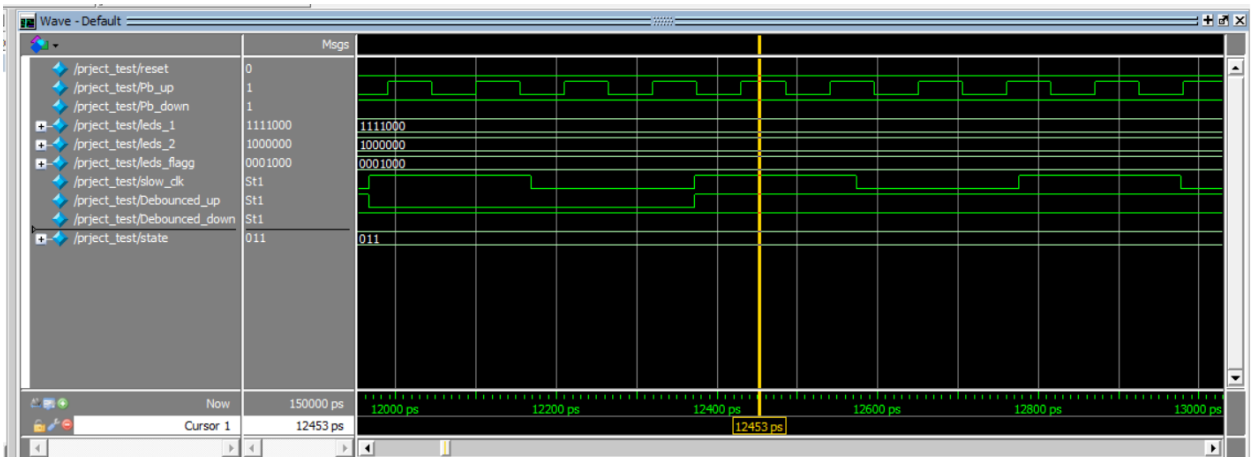


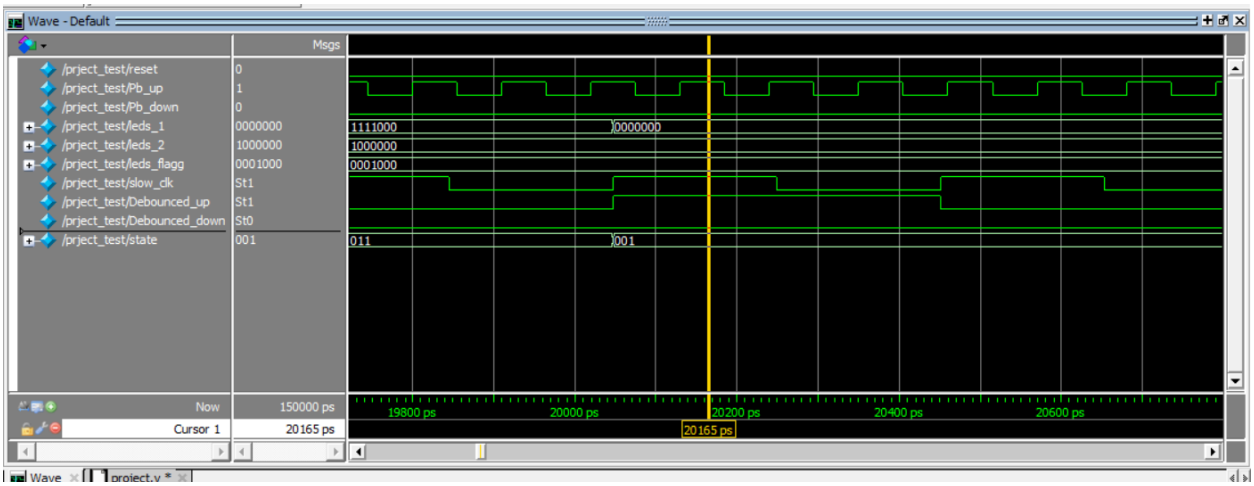

- When car leaves garage number of cars decrement by 1.
- *State was up then become "down".*




- *Results output example.*

- When both cars enter and leave the garage number of cars remain the same
- State become “Remain “.




Wave - Default
Msgs
/prject_test/reset
/prject_test/Pb_up
/prject_test/Pb_down
/prject_test/leds_1
/prject_test/leds_2
/prject_test/leds_flagg
/prject_test/slow_clk
/prject_test/Debounced_up
/prject_test/Debounced_down
/prject_test/state
0
1
0
0000000
1000000
000 1000
St1
St1
St0
001
1111000
0000000
1000000
000 1000
011
001
Now
150000 ps
Cursor 1
20165 ps
19800 ps
20000 ps
20200 ps
20400 ps
20600 ps
20165 ps
Wave
project.v *

- *Results output example.*

- when garage reaches his maximum capacity which is (50)
- no cars can enter garage && Flag 7_segment display (F) full
- state becomes full