

Traffic Light Controller using FPGA

ANANDITA M B , SAI BHARADWAJ

April 27, 2019

1 Objective

The aim of the project is to model 4 way traffic light controller using FPGA

2 Why use FPGA?

- FPGA (Field Programmable Gate Array): This is an IC that contains an array of logic cells that can be programmed by user.
- FPGA has many advantages over microcontroller in speed, number of input and output ports & performance.
- FPGA is cheaper solution when compared to ASIC which is too costly and time consuming for small scale production
- In general, traffic lights on main roads are controlled with a fix-time control system which may lead to traffic congestions during rush hours
- VHDL is preferred especially for FPGA design because VHDL can be used to describe and simulate operation of detail circuits

3 Steps involved

- Transform word description of the protocol in to a Finite State Machine transition diagram.
- Implement simple Finite State Machine using VHDL
- Simulate the operation of FSM

- Implement the design on to a FPGA

4 State table

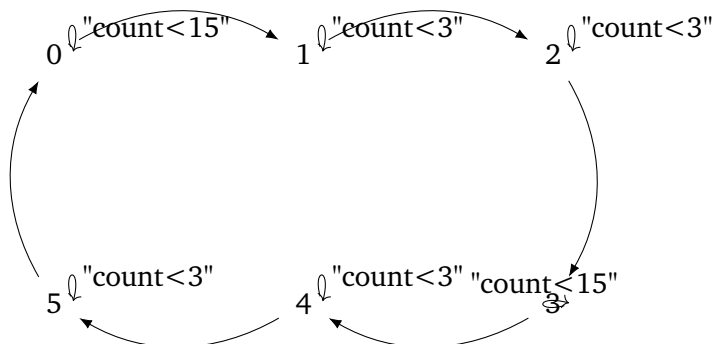
- The three lights (Green , Yellow , Red) cycle through the six states as shown in the table

State	North-South	East-West	Delay
0	Green	Red	5
1	Yellow	Red	1
2	Red	Red	1
3	Red	Green	5
4	Red	yellow	1
5	Red	Red	1

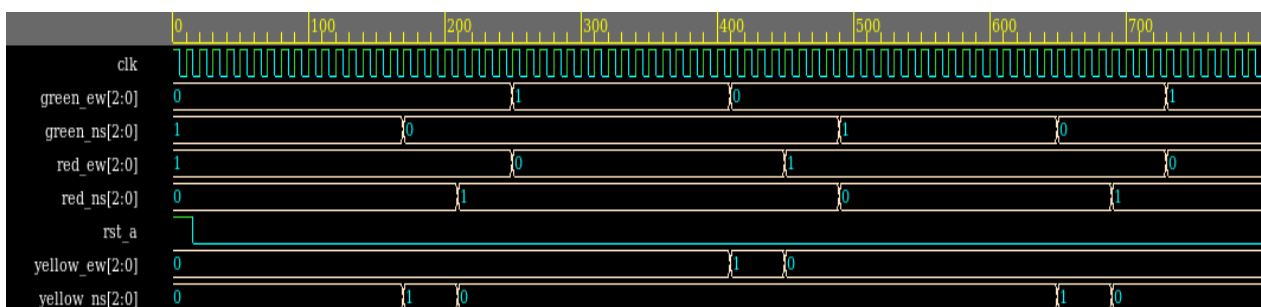
Table 1: Table showing different states and there corresponding delays

5 State diagram

- If we use 3 Hz clock is used to drive this state diagram then a delay of one second is achieved by staying at one state for three clock seconds



6 simulation



7 Implementation

Implementation details for simulation and for FPGA has been uploaded in the following github link

- https://github.com/Daavat/FPGA_lab/tree/master

8 References

- <https://www.fpga4student.com/2016/11/verilog-code-for-traffic-light-system.html>
- <https://vlsicoding.blogspot.com/2013/11/verilog-code-for-traffic-light-control.html>
- <https://www.slideshare.net/UtkarshDe/four-way-traffic-light-control-using-verilog>
- <https://www.ee.iitb.ac.in/vlabsfpga/docs/Expt3/tutorial.pdf>