A VLSI Implementation of Three-Lift Controller Based on Verilog

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Abstract: The high growth of the semiconductor industry over the past two decades has put Very Large Scale Integration in demand all over the world. The basics of digital logic theory and techniques are easily understood by the design based on VLSI technology. These are the core fundamentals of the fast, high-speed complex digital circuits. As day to day the technology is gradually improving. So obviously the designs have to be made simpler for enjoying the benefits. To do that, a Three-Lift Controller is modeled. In the proposed design a VERILOG RTL code is developed to control the lift moment based on the request it will get. For that a finite state machine is developed to know from which state to state the controller is changing based on the requests from the end user. Lift is also called as Elevator or car. The design is based on the synchronous input which should be operating with a fixed sort of frequency. Finally the RTL is verified and implemented in XILINX ISE. In this work, the real-time three-lift controller will be modeled with Verilog HDL code using Finite-State machine (FSM) model to achieve the logic in optimized way.

Keywords: FSM, Controller, Elevator control.

1. Introduction

An elevator is a device designed as a convenience appliance that has evolved to become an unavoidable feature of modern day urban life. An elevator is defined as, “A machine that carries people or goods up and down to different levels in a building or mine”. While a standalone elevator is a simple electro-mechanical device, an elevator system may consist of multiple standalone elevator units whose operations are controlled and coordinated by a master controller. Such controllers are designed to operate with maximum efficiency in terms of service as well as resource utilization. This project details the design of a elevator controller using VERILOG.

The Elevators/Lifts are used in multi store buildings as a means of transport between various floors. Elevator is a device designed as a convenience appliance that has evolved to become an unavoidable

features of modern day in urban life normally .The lifts is controlled by Microprocessor based systems, which are costlier. It is proposed to design a low cost and compact dedicated controller. The Elevator Controller is a device used to control a lift motion and to indicate the direction of motion, and the present floor level, etc. The device control the lift motion by means of accepting the floor level as input and generate control signals (for control the lift motion) as output.

We developed a VERILOG code for 3-story elevator control system for the cases of elevator moving up and down. The design and simulation of the Elevator controller can be performed using VERILOG. Also the Timings of various signals can be verified. VERILOG is a hardware description language used in electronic design automation to describe digital and mixed-signal systems such as field-programmable gate arrays and integrated circuits. The key advantage of VERILOG when used for systems design is that it allows the behavior of the required system to be described (modeled) and verified (simulated) before synthesis tools translate the design into real hardware . VERILOG project is multipurpose. Being created once, calculation block can be used in many other projects. However, many formational and functional block parameters can be tuned that are capacity parameters, memory size, element base, block composition and interconnection structure.

2. PRINCIPLE OF ELEVATOR CONTROLLER

Elevator controller is an elementary system consisting of elevator serving 3 floors. The elevator car has a pair of control buttons (up / down) for moving the elevator up and down. The floors also have call buttons to call for the service of the elevator system. The following principles have been applied during the design of the elevator controller:

The floors are defined as first floor and second etc .

- A floor call is serviced using the elevator.
- Upon arrival at a floor, the doors open immediately.
- Doors remain open before closure.
- If an obstruction is detected when door is about to close, it remains open
- Each elevator car is treated as a sub-system controlled by the controller.
- Elevator Up / Down buttons are connected to elevator units.

• Each door unit is treated as a sub-system controlled by the respective elevator car.

• Floor call buttons are connected to the elevator controller.

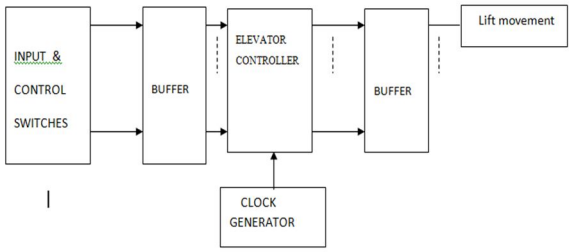

Figure 1 Block diagram of Elevator Controller

STATE FLOW

The entire elevator controller system has been treated as a collection of smaller sub-systems viz. door units, elevator units and the master controller. The following sections describe these subsystems.

ELEVATOR UNITS:

The elevator units are controlled by the master controller through a set of elevator commands. The status of each of the elevator units is passed on to the master controller as an input. Table below shows the model commands and corresponding state transitions.

3. Results and Conclusions

In this paper the proposed design used Xilinx-ISE tool for logical verification, and further synthesizing it on Xilinx-ISE tool using target technology and performing placing & routing operation for system verification. Figure 3 shows the simulation result of the designed elevator controller and Figure 4 & 5 shows the RTL schematic of the design. The device utilization summary is shown in Table 1. From the device utilization summary it shows that the resources consumed for developing this system is very less.

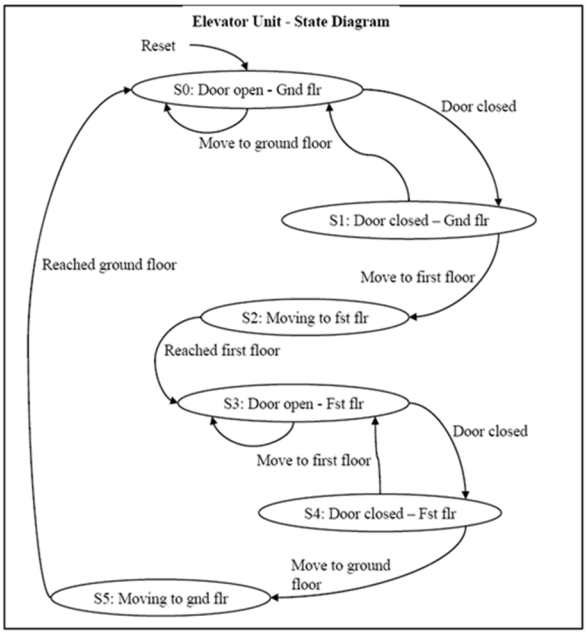

Figure 2 MODEL FLOW DIAGRAM FOR THE ELEVATOR UNIT

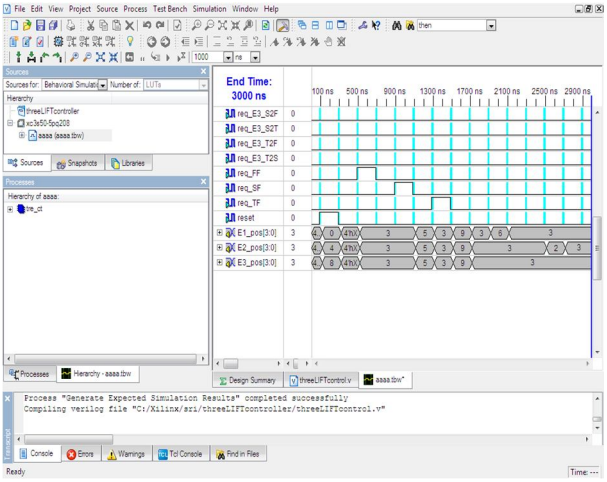

Figure 3 Simulation Results

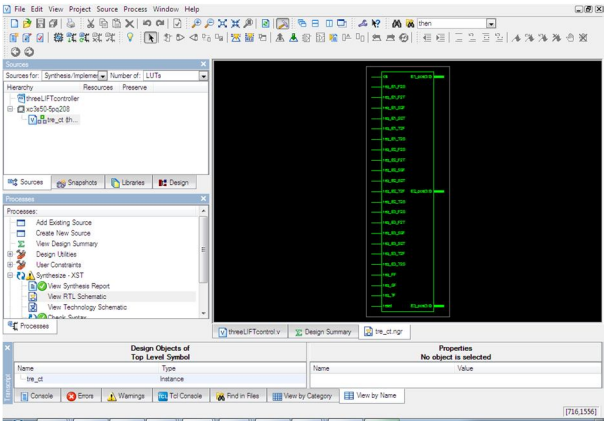

Figure 4 RTL SCHEMATIC

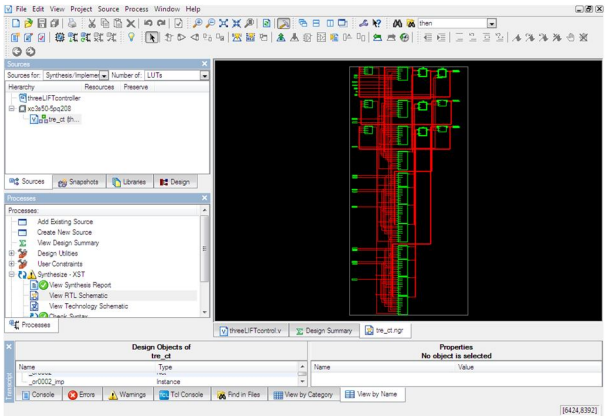

Figure 5 RTL SCHEMATIC

Table 1
Device Utilization Summary (estimated values)

Logic Utilization	Used	Available	Utilization
Number of Slices	20	768	2%
Number of Slice Flip Flops	24	1536	1%
Number of 4 input LUTs	31	1536	2%
Number of bonded IOBs	32	124	25%
Number of GCLKs	1	8	12%

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