COMPUTER ARCHITECTURE PROJECT REPORT

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Course: Microprocessors and Embedded Systems (COM3525-B)

AIM OF THE PROJECT

Learning simple coding with hardware description language, VHDL and understanding the digital and mixed-signal systems. In the end developing simple minded traffic lights simulation.

THE PROBLEM

Understanding the concept of signal systems and trying to use them in real life problems such as traffic control lights, with help of VHDL. Deciding states of traffic lights and handling all situations that may be encountered in real life. Realizing differences between real time problems and computer base codes.

VHDL LANGUAGE

The language has complex syntax especially assigning signals, signal-vectors. But visualizing with ModelSim and compare all signals second by second, even nanoseconds, helps to understand how signals behave in digital systems and even though everything happens in nanoseconds making a small logical error, it may look like logically correct on paper, may cost seconds. To avoid that, understanding how real times events works and how codes on paper converts into real time solutions might be crucial. In VHDL language concept of process has a very important role. Since everything happens in nanoseconds and the environment, thread concept of computers, may effect order of processes in run time and that can cause significant problems. To avoid this situation ordering all processes with help of wait statements or other methods are required.

IMPROVE THE SIMULATION

To improve the simulation firstly we have to understand the problem. As shown at the Figure-1 we have four traffic lights and in total we have eight states. Red light for all directions, red and yellow light for either north-south directions or east-west directions, green light for either north-south directions or east-west directions, only yellow light for either north-south or east-west directions. But in all cases nobody can turn left. This simulation is very simple and in real life examples we don't encounter such situations. We can handle this problem adding more states, like the cases not for combined of north-south or east-west but we can
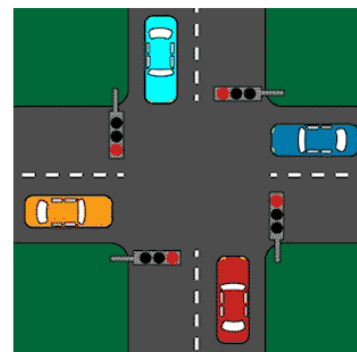

Figure-1

think them as individual cases. But in the end we will have double amount of states more signals to handle and for drivers more turn-time to wait. If we know which directions are more used (main road) we can improve this idea too. Giving all directions 60 seconds green light might be cost time efficient for drivers. Since some directions are not used more frequently as the other directions, so we can reduce the seconds in green light states or giving them one green light state in two turns instead of one turn. This might improve the time efficiency for simulation but we have to handle more complex states and signals. In the end while we are improving some parts in our simulation we have to give up some parts like hardware and software.