Laboration 1
SystemC TrafficLight

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1 Introduction

2 Section Name

2.1 Function 1

3 Generator module

The generation module allows to simulate the passage of cars in all directions in order to show the different properties of the lights. Two different generators are used as testbench and will be the input to the sensor modules. The first one generates pseudo-random cars in order to show the behaviour of the fires in function of time. The other generates cars by reading a pre-written.txt file to show all possible cases one by one.

The generator contains a print method, a generator method and a thread to trigger the generator method.

3.1 Event thread

The event_creator is a thread that triggers the generator method every two seconds. The generator will send a 1 if there is a car or a 0 if there is no car.

3.2 Random generator method

With each tic caused by the event, each module has a 30% chance of generating a car.

The sensor module (which will be explained later) requires a change of state to take into account the passage or not of a car. For example, if the generator sends five 1s in a row, the sensor will only take into account the first car. To avoid this problem we use a toggle that allows you to go back to the low state with each car you meet. In our example, the sensor will therefore see all five cars.

3.3 Generator method

The other generator will read a dedicated text file according to its direction to show the different properties. All cases are presented below:

N	:	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
S	:	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0
E	:	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
W	:	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
		N	-	N	-	N	-	N	-	N	-	N	-	N	-	N	-
		-	S	S	-	-	S	S	-	-	S	S	-	-	S	S	-
		-	-	-	E	E	E	E	-	-	-	-	E	E	E	E	-
		-	-	-	-	-	-	-	W	W	W	W	W	W	W	W	-

4 Controller module

The controller module contains all to the logic needed to control a traffic light in a four-way junction with traffic flowing in four directions. However does not support turning traffic, for example, a car can't go from north to west. The module has four input signals, one form each direction. This signal tells the controller if there are any cars waiting for a green light. There are also four boolean output signals to represent a green or red light. The controller has one thread and a print method. The print method is triggered by the tread and prints the current state of the traffic lights. The controller's thread is covered in greater detail in the next section.

4.1 Controller Thread

The controller thread contains a state machine with seven states. The states are "*WEST, EAST, EAST_AND_WEST, SOUTH, NORTH, NORTH_AND_SOUTH, NONE*". These states each represents one or two traffic lights. There are states that enable green light for two directions at the same time. This is due to the fact that cars from the north and south or east and west doesn't cross each other's driving lanes. Thus there is no problem if both have a green light at the same time. The *NONE* state is for when there is no cars.

To transition between states the machine uses the input signal to check if there is cars waiting for a green light in any one of the four directions north, south, east and west in combination with some logic in the states. This logic for the states is described below.

A transition from one of the one-directional states can happen in one of four ways. First of if there are no more cars watching for green light the state machine will switch state to *NONE*. Secondly, if there are one or more cars in the opposite direction the machine will switch state to the corresponding dual light state. This will keep the current green light green and switch the light for the opposite lane to green as well. The final two ways is if there is one or more cars waiting in either of the crossing directions. Then the machine will wait for six seconds, this enables at least three cars to cross before swishing the signals.

The procedure for transitioning from a bidirectional state is largely the same. With one addition if there are no cars left waiting for a green light in any of the directions that the state represents the machine will switch to the correct one directional state. The criteria for switching to the *NONE* state is also for there to be no cars in either of the directions of the state.

The state machine is implemented using a systemC thread, this is so it can control the time that the output signals are high or low. This enables the state machine to stay in one state for a specific period of time. This is required for good traffic flow through the junction.

5 System

The traffic light system has four generator modules, four sensors modules and one controller module. There's one generator and sensor per direction. Each generator have a out channel to a sensor. Each sensor have a out channel to the controller. The controller have four out channels, one for each sensor. See figure 1 for a visual representation.

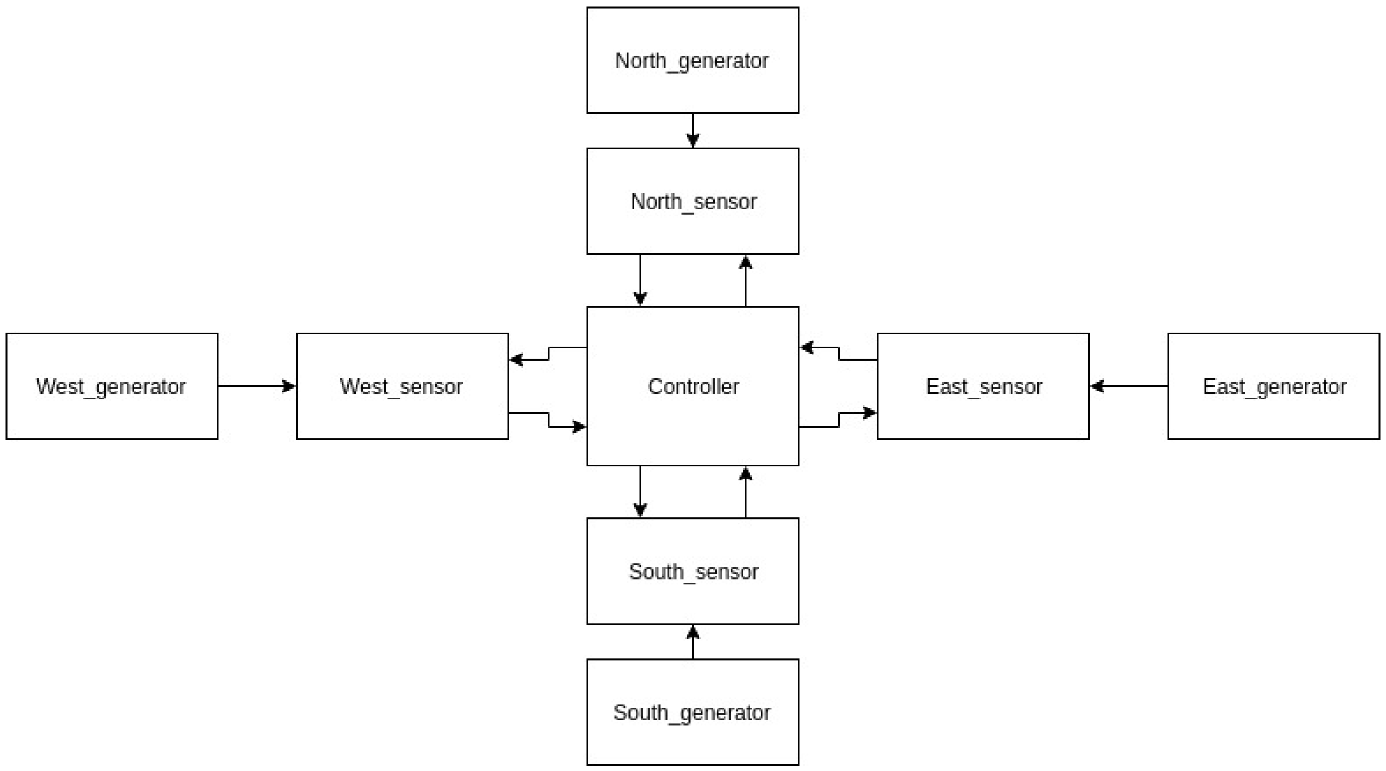

Figure 1: Traffic light system.