Project 4

Car key controller FSM

Due 19/04/2021

Design a controller for a car key-remote control unit that controls the doors, trunk and lights of a Car remotely.

- The remote control includes 4 buttons, the top left button TL locks the doors, top right button TR unlocks the doors, bottom left BL button turns the lights on/off, and the bottom right BR button controls the trunk.

- If pressed less than 5 seconds, the bottom right button simply locks/unlocks the trunk (if trunk is currently down) whereas if pressed 5 seconds or longer, it unlocks and lifts the trunk up (if trunk is currently down). If trunk is currently up, it brings the trunk down and locks it.

- You can assume outputs DL, DUL, TRL, TRUL, TRUP, TRDWN, LON, LOFF to perform door locking, door unlocking, trunk locking, trunk unlocking, trunk lift up, trunk down, lights on, lights off respectively. The outputs should stay on for one cycle when generated and then go back to inactive state.

- The BL button makes the light on if it is currently off and vice versa.

- Sensor LIGHT=1 indicates that rights are on and sensor TRUNKD =1 indicates that trunk is down.

- Assume that a 200MHz clock is used in the controller.

Problems

1. Construct a state diagram for this controller. You may assume that only one of the four buttons can be pressed at any given time time - 20 points.

2. Write the corresponding VHDL code and test it. For testing your design, model a random sequence of key inputs that a user might try with the controller in the morning of a trip to the airport (ie. think of a sequence of your own). Describe your approach including the choice of random arrival times and any graphs that you obtained to demonstrate that your code works correctly - 80 points.

Upload a pdf file that describes (1) and (2) above, and also upload the VHDL codes and test benches necessary for us to verify that your code works.