Project

Home Automation System

Description

Home automation involves a number of factors including:
- Security: where the system is concerned with home intrusion detection and avoidance.
- Environment factors: such as temperature and fire detection.

The system is designed to control the doors, windows, fire alarm and the temperature. Each process being automated is associated with a sensor.
- When the sensor is LOW (0) then no action is needed, and the next device can be checked.
- When the sensor is HIGH (1) then an action is needed.

System Specifications

- **Front and Rear doors:**

    There are 2 doors: a front door and a rear door each has a separate sensor. These sensors are always LOW indicating that the doors are closed. If any of these sensors turns HIGH (indicating the door is open), the door associated with the sensor is closed automatically and an output signal goes HIGH indicating this action.

- **Window:**

    There is a sensor indicating the status of the window. The sensor is always LOW indicating that the window is closed. If the window is open, then the sensor is HIGH, and a system buzzer starts.

- **Fire Alarm:**

  A smoke detector is used, if there is any smoke then the sensor is HIGH and, the fire alarm starts.

- **Temperature:**

  The range from 50 to 70 degrees F is the normal comfortable temperature range. The change in the room's temperature is measured through a sensor. If the temperature is below 50 degrees F, then the heater is automatically turned on. If the temperature is above 70 degrees F, then the air conditioner is automatically turned on.

The priority among different actions is as follows:

1. Front door
2. Rear door
3. Fire alarm
4. Window
5. Temperature

  where 1 is the highest priority and 5 is the least priority.

Design

The inputs are as follows:

Clk	The system's clock
Rst	Resets the system
SFD	Signal from the sensor on the front door
SRD	Signal from the sensor on the rear door
SW	Signal from the sensor on the window
SFA	Signal from the sensor on the fire alarm
ST	Signal from the sensor on the temperature controller, this signal indicates the temperature's degree

The outputs are as follows:

fdoor	Goes HIGH if front door is closed automatically
rdoor	Goes HIGH if rear door is closed automatically
winbuzz	Goes HIGH if window is open
alarambuzz	Goes HIGH if fire alarm is on
heater	Goes HIGH if temperature is less than 50 degrees F
cooler	Goes HIGH if temperature is higher than 70 degrees F
display	3-digit binary display indicating the system's state where state= 0: start, 1: front door, 2: rear door, 3: fire alarm 4: window, 5: heater, 6: cooler.

Requirements

1. "Design" and "Implement" the system in a hardware description language (VHDL or Verilog). (Hint: consider using FSM).
2. "Synthesize" the code making the area, time and power most optimized. (In this point a **comparative evaluation** may be carried among the different class teams).
3. Perform "Post-Synthesis Simulation".
4. Perform "Floor Planning" and "Routing".

Deliverables

- All the **code** files, all the **scripts** used, all the generated **reports**, all **do** files and **test benches.**
- A document showing the system **design**, **metrics** obtained in the reports and **schematic figures** of the generated output.

Due Date: 2 January 2022 at 1:00 p.m.