

Class:	CPE100L - 1002	Semester:	Spring 2020
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		Document topic:	Postlab 9
Instructor's comments:			

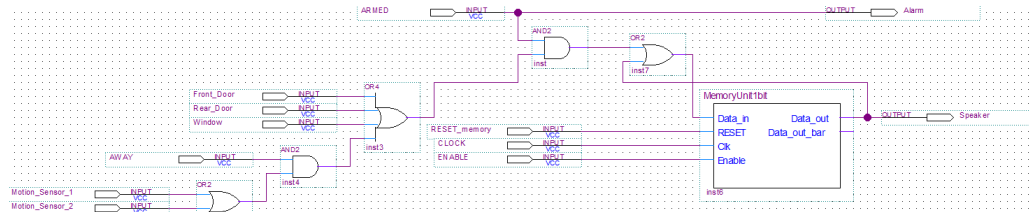
1. Introduction / Theory of Operation

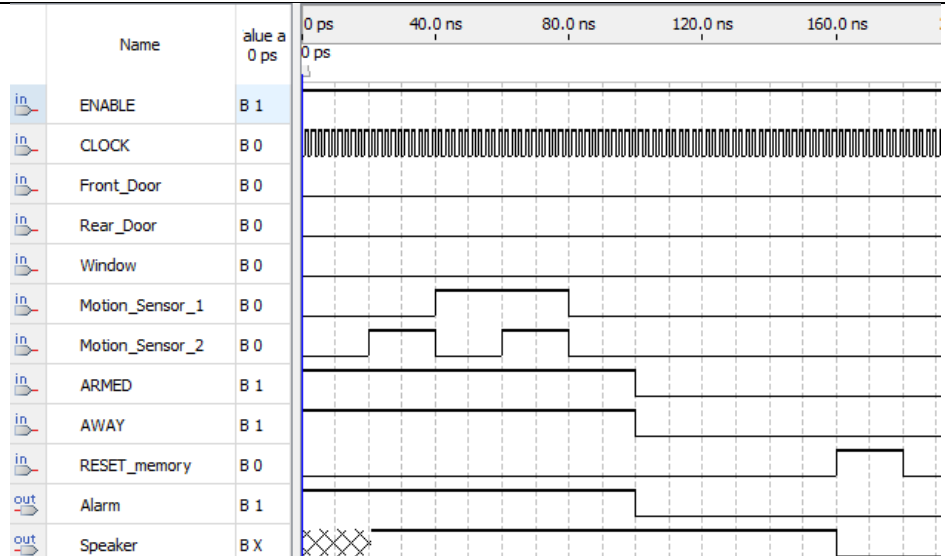
Lab 9 is about designing a simple house alarm system, then equipping it with some more functions.

2. Prelab Report

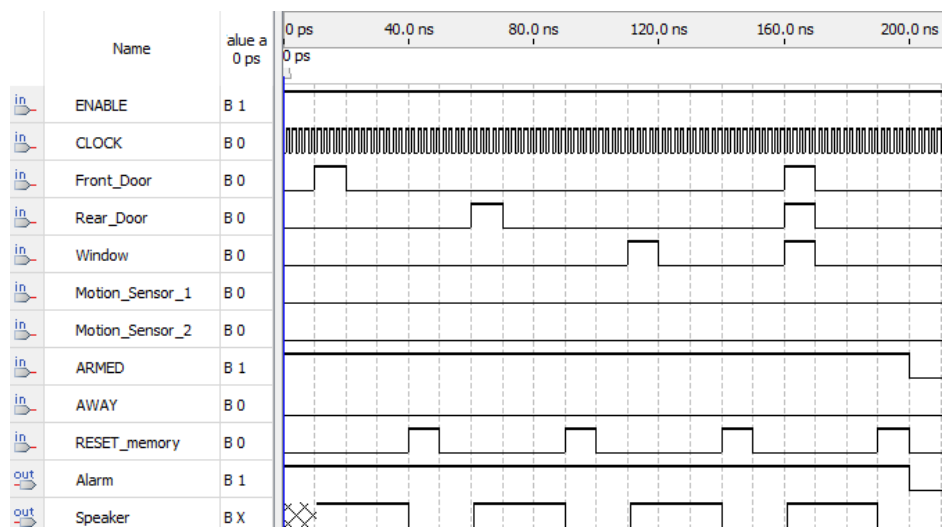
My prelab report will be attached with the submission.

3. Results of the Experiments

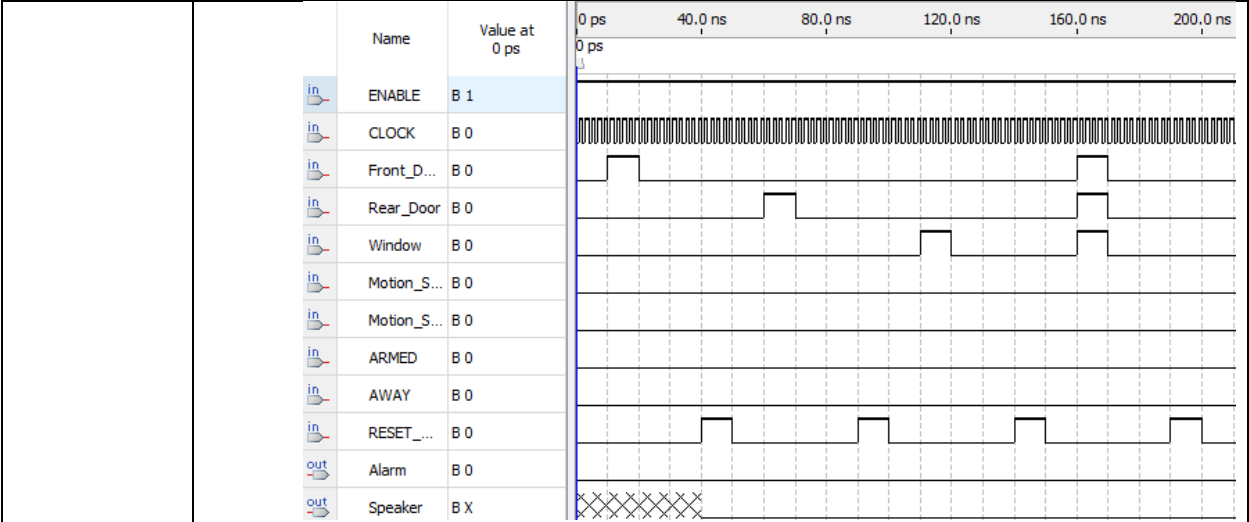
Experiment	Experiment Results
1	<p>a. Schematic</p>  <p>b. Description of operation and how memory was implemented</p> <p>In addition to the combinatorial logic that turns the alarm system on, the memory unit allows for the alarm to stay on even when the original reason disappeared. Once the siren is triggered on, the speaker will be “1”, but when the sensor is back to 0, the speaker will be “0”. The additional RESET input resets the speaker back to “0”.</p> <p>c. Detailed description of simulation</p>



This is a waveform showing the first case when the alarm is armed and occupants are away from the house, input from the motion sensor 2 triggers the speaker to be “1”. Once the reset is on, the speaker goes back to “0”.



This is a waveform showing the second case when the alarm is armed, then only output from the sensors at the front, rear doors, and windows will activate the alarm systems. As you can see from the speaker waveform, it is inactive when none of the front, rear, or windows are on. Then when front door, rear door, or window is open, speaker turns on until the reset turns it off. Lastly, when the front door, rear door, and window are open, then the speaker is also on until the reset turns it off.



As you can see from this last case, if the alarm is not armed, then there will never be an alarm and the speaker will not sound.

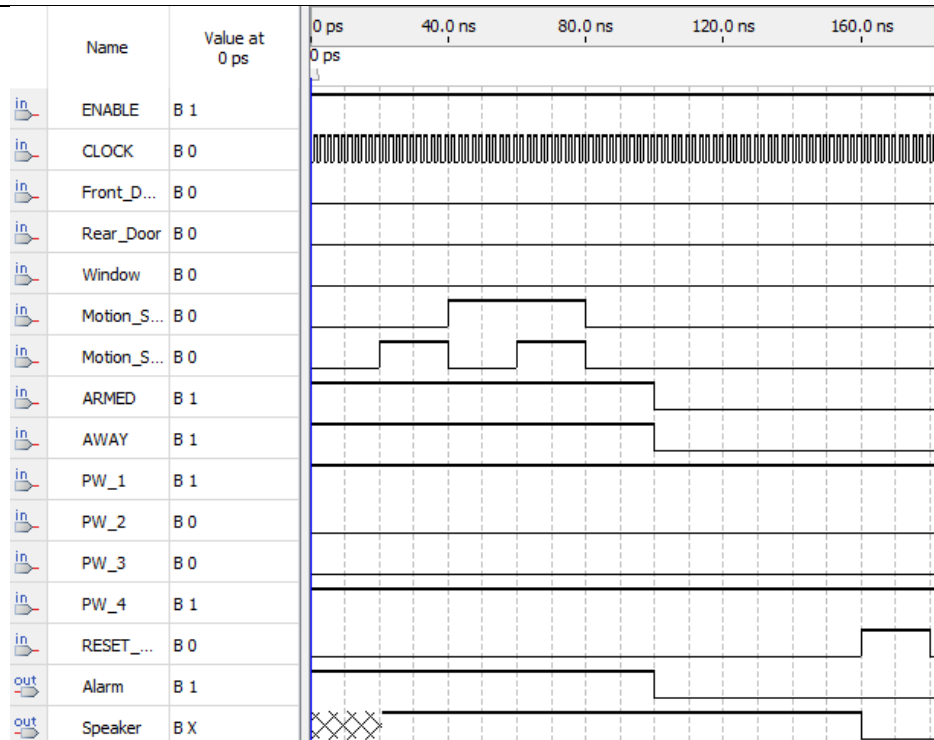
2

a. Schematic

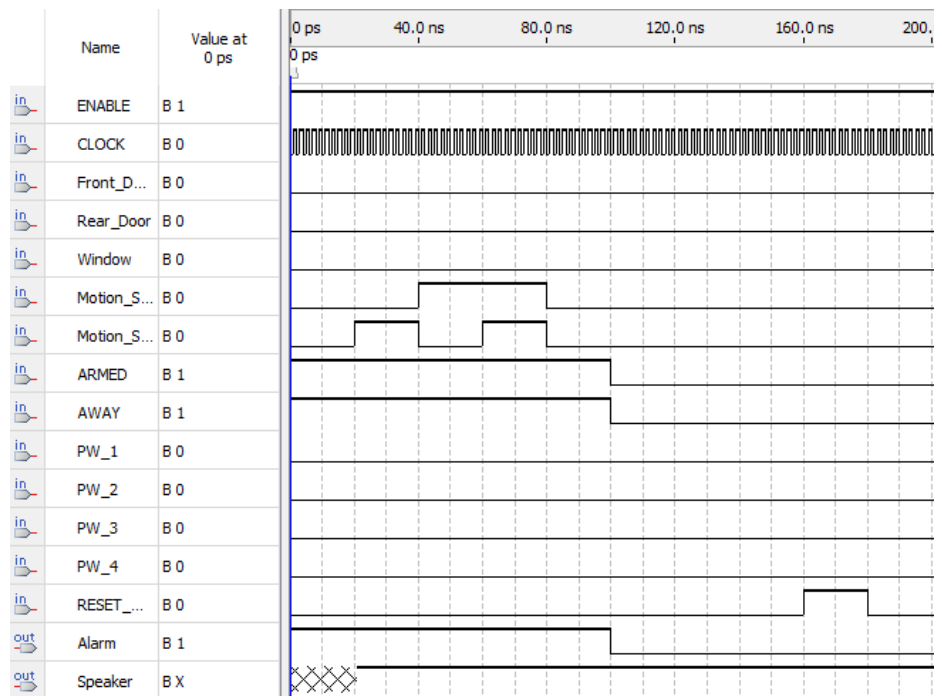
b. Description of the operation and how the password was implemented

The alarm system still works like in experiment 1, except the 4-bit password mechanism works with the reset to turn off the siren. The 4-bit password I used was 1001, which needs to all be true in order to turn off the alarm.

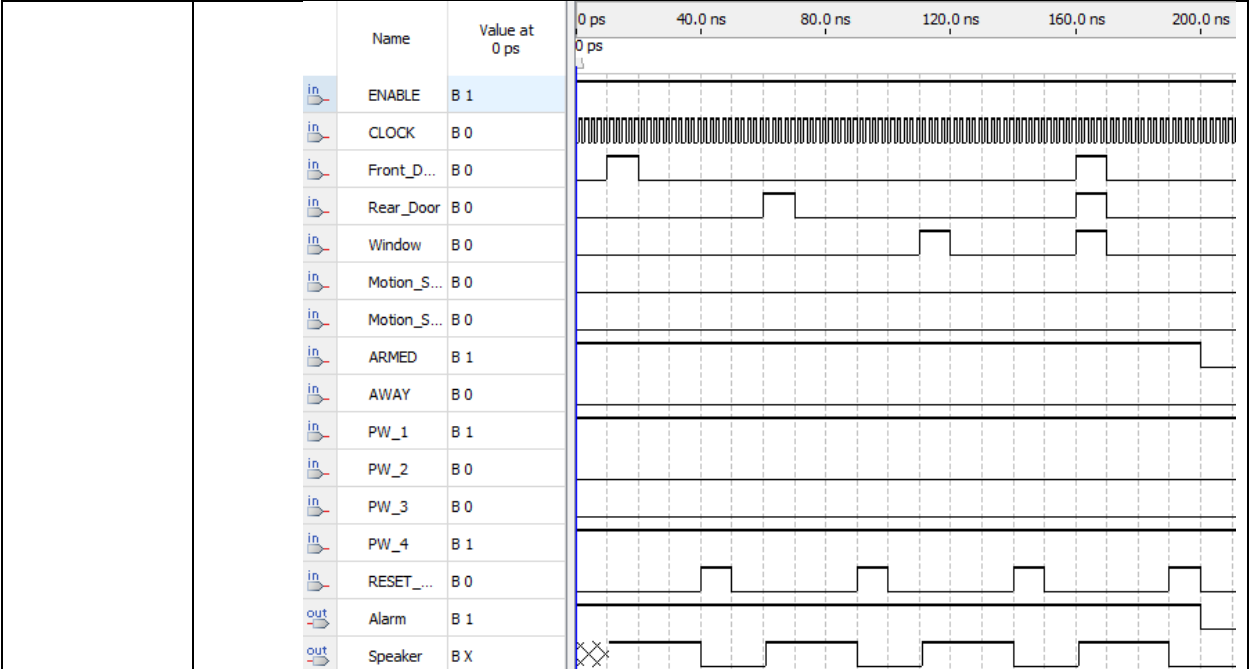
c. Detailed description of the simulation



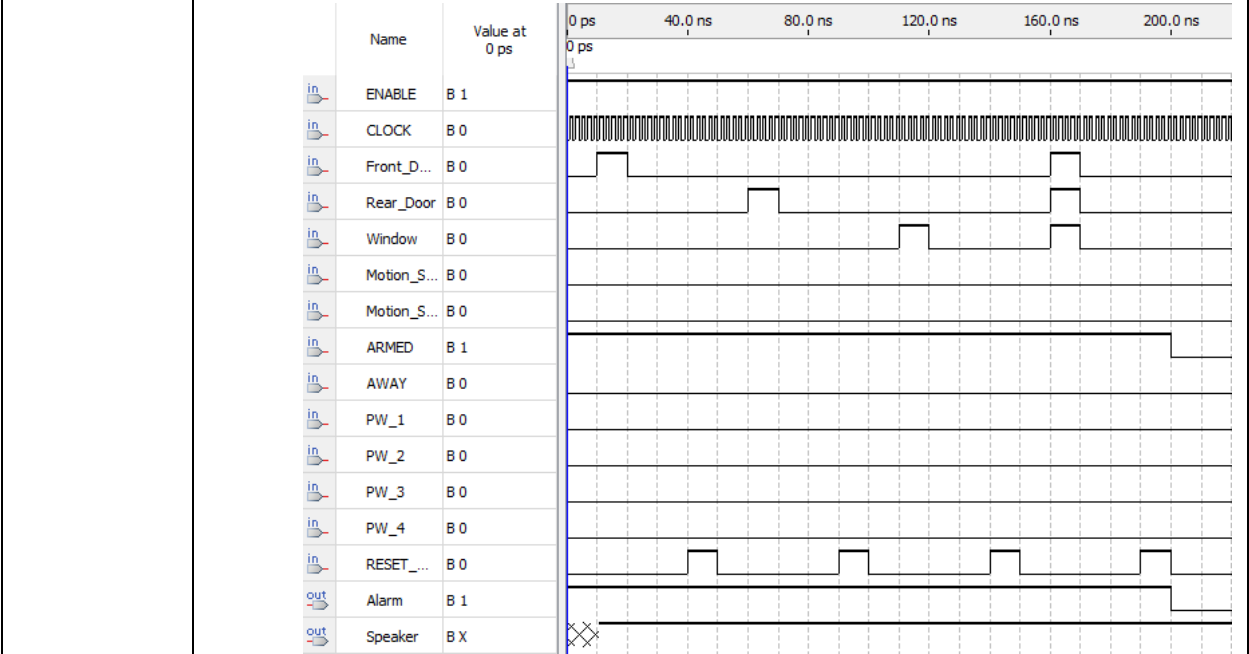
This waveform is the first case where the alarm is armed and the occupants are away from home and motion sensor 2 activates the speaker. As you can see, if the password is 1001, then the reset turns off the speaker.



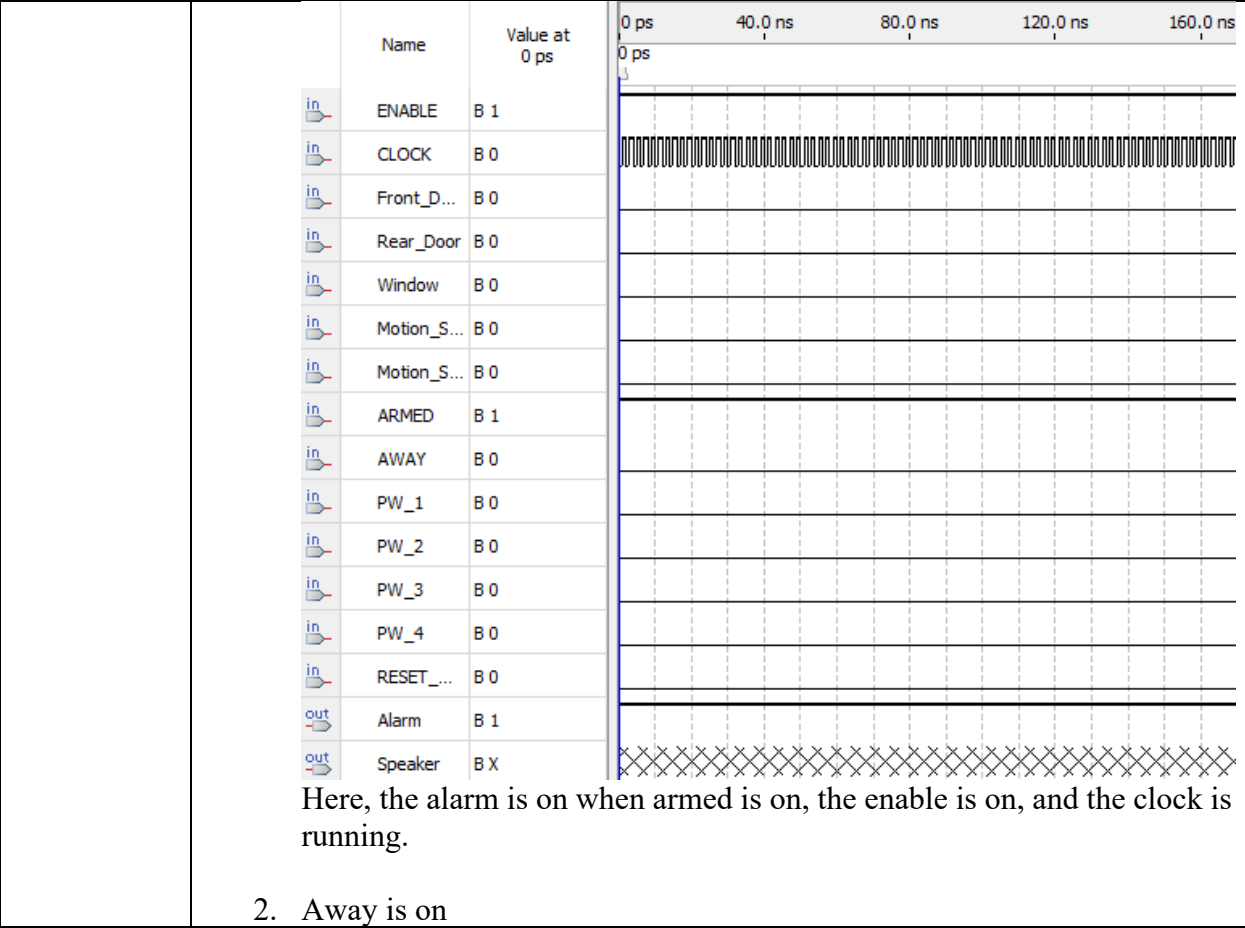
As you can see here, this case is the same as the first case where the alarm is armed and the occupants are away from home with the sensor 2 activating the speaker, but the incorrect password keeps the speaker on.

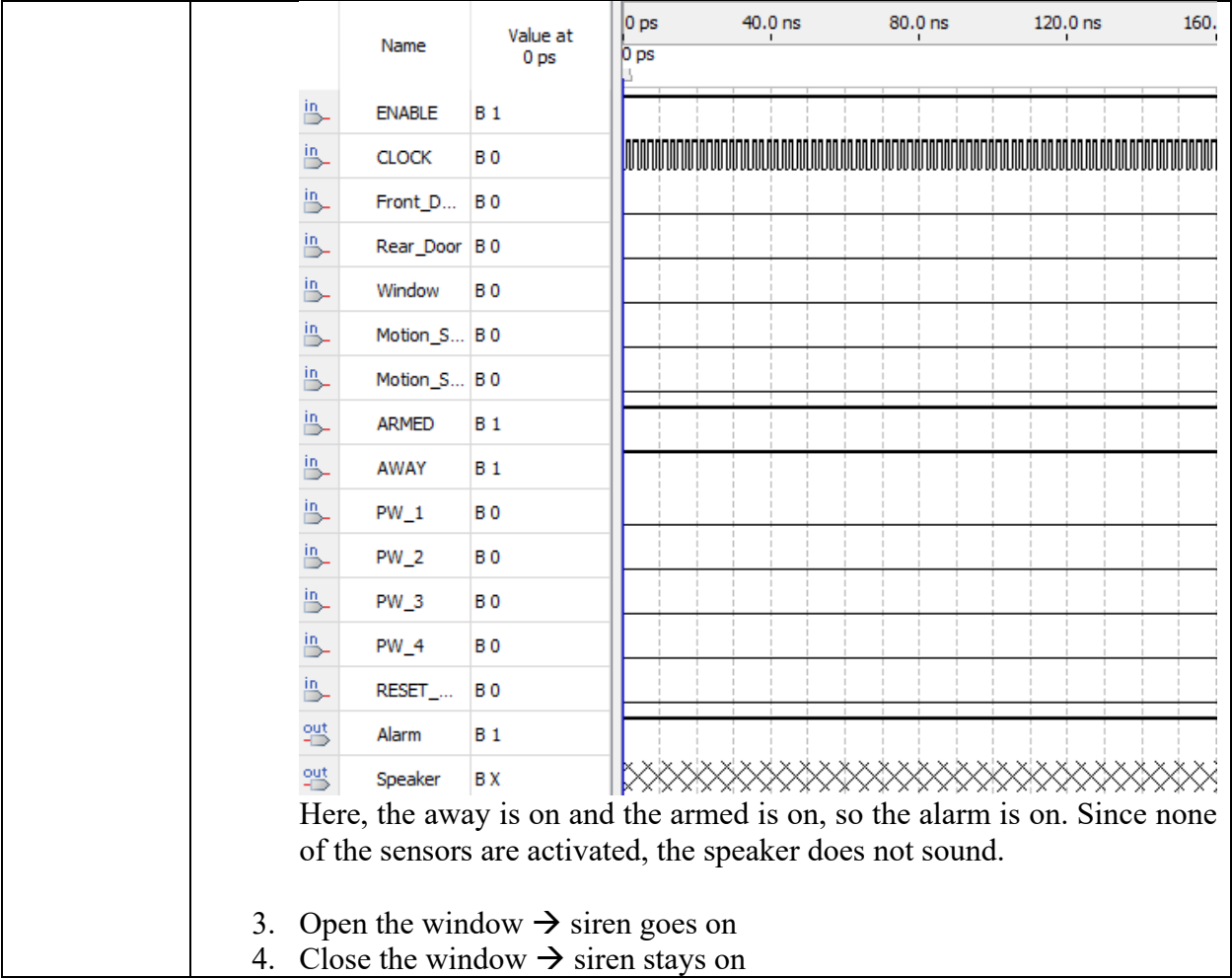


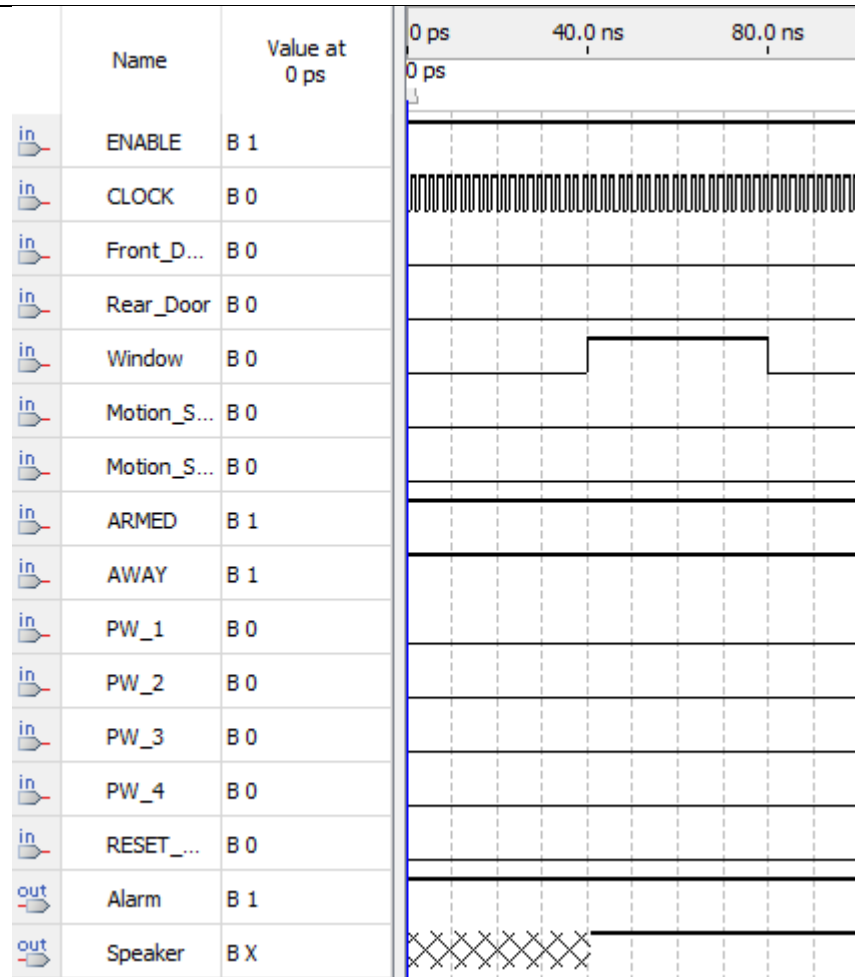
This waveform is the second case where the front door is open, rear door is open, window is open, none of them are open, or all of them are open. When the password is 1001, then the reset works and resets the speaker to “0”.



This waveform is the same as the second case where a combination of the front door, rear door, or window are open, but when the password is incorrect, then the reset does not reset the speaker to “0”, but stays “1”.

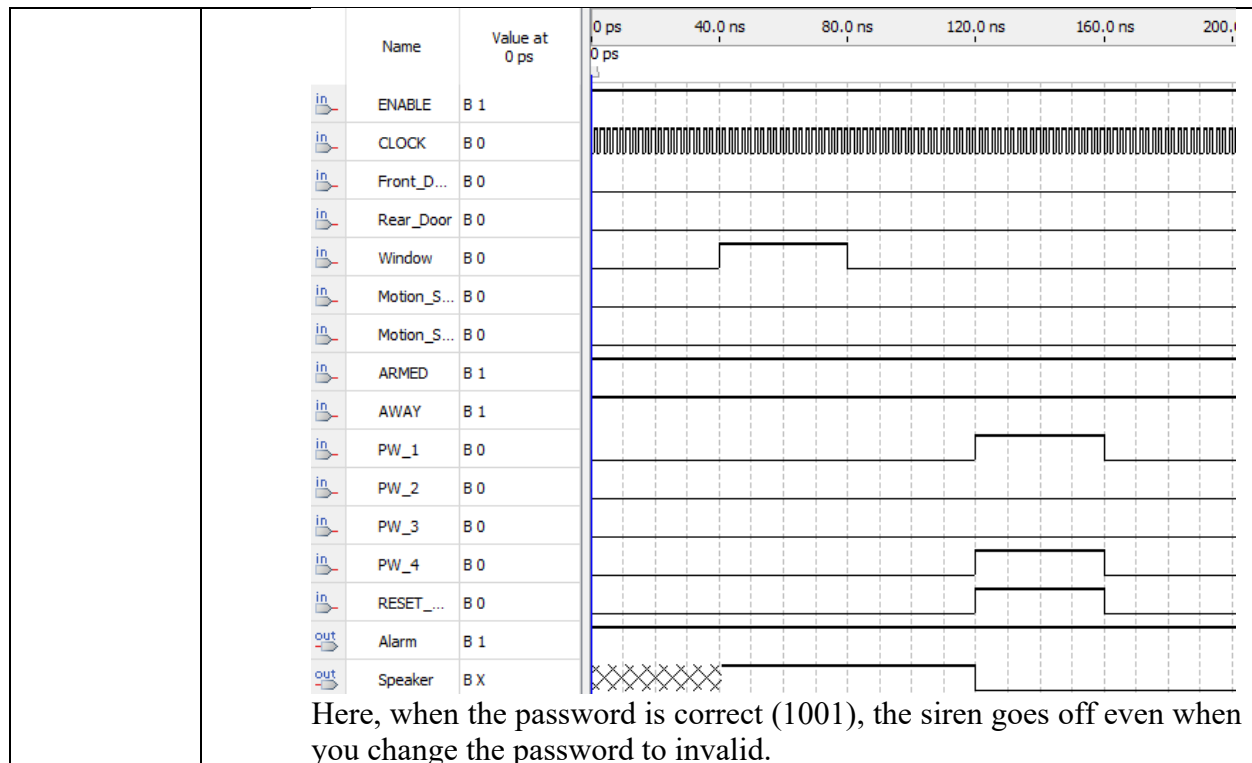






Here, when the alarm is armed and away, and the window is open, the alarm is on and the speaker goes off since the window is open. The speaker does not go off until the window is open. Even when the window is closed, speaker stays on.

5. Enter the password → siren goes off
6. Change the password to invalid → siren stays off



4. Answer the questions

1. A motion sensor that could be used in my circuit is the GE Choice Alert Wireless Alarm System Silent Alert. It has an alarm siren, wireless keypad, and window/door sensor. Instead of the speaker, there would be an LED to indicate the alarm going off.
2. For the alarm schematic, I took it step by step by designing the motion sensors and door or window sensors to go off with the alarm step by step with logic gates that would make sense for each case. When I got to the house alarm with memory without password, I used the 1-bit memory unit and experimented with different ways in addition to Smit's assistance via WebEx. For the 4-bit password mechanism, I connected 4 inputs to an AND gate, then I connected that output to an AND gate with the reset input in order to connect it to the 1-bit memory unit.
3. The most difficult element during the alarm design was the addition of the 1-bit memory unit in order to make the alarm stay on even after the original reason disappeared.

5. Conclusions

Overall, the lab was fun but difficult to implement due to the amount of time taken to design the alarm system with logic gates. With this, I learned that the 1-bit memory unit helps keep the previous state so that the alarm can stay on even after the original reason disappeared. The problem I encountered was how to make the speaker work properly as an output that would also work like a real siren through the memory cell. In order to solve this problem, I discussed with Smit via WebEx in order to properly implement the speaker and the alarm outputs.

