Digital Logic: Seatbelt

12/7/23

Design Brief: We are using sensors for the door, ignition, and seat belt clip. We will design a circuit that will provide an alarm when the door is closed, the ignition is on, and the seat belt is not buckled. We will use a MYDAQ board, A.O.I. chips, and wire, constrained to a 5" x 4" space. The design will be completed by Friday, December 15, 2023. ✓

Define Variables:

door sensor = D ✓ (0 = open ; 1 = closed)
ignition sensor = I (0 = off ; 1 = on)
seat belt sensor = S (0 = unclipped ; 1 = clipped)
alarm = A (0 = off ; 1 = on)

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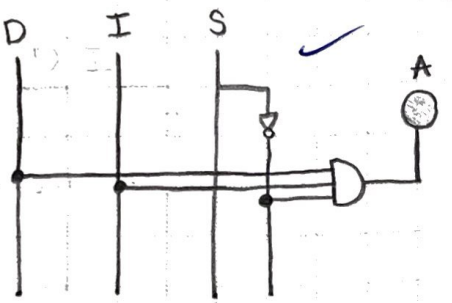
Truth Table: ✓

D I S	A
0 0 0	0
0 0 1	0
0 1 0	0
0 1 1	0
1 0 0	0
1 0 1	0
1 1 0	1
1 1 1	0

Expression: ✓

$A = DI\bar{S}$

Schematic:



✓

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DATE 12/8/2023

WITNESSED BY
DATE 12/8/2023

TITLE

Digital Logic: Seatbelt (2)

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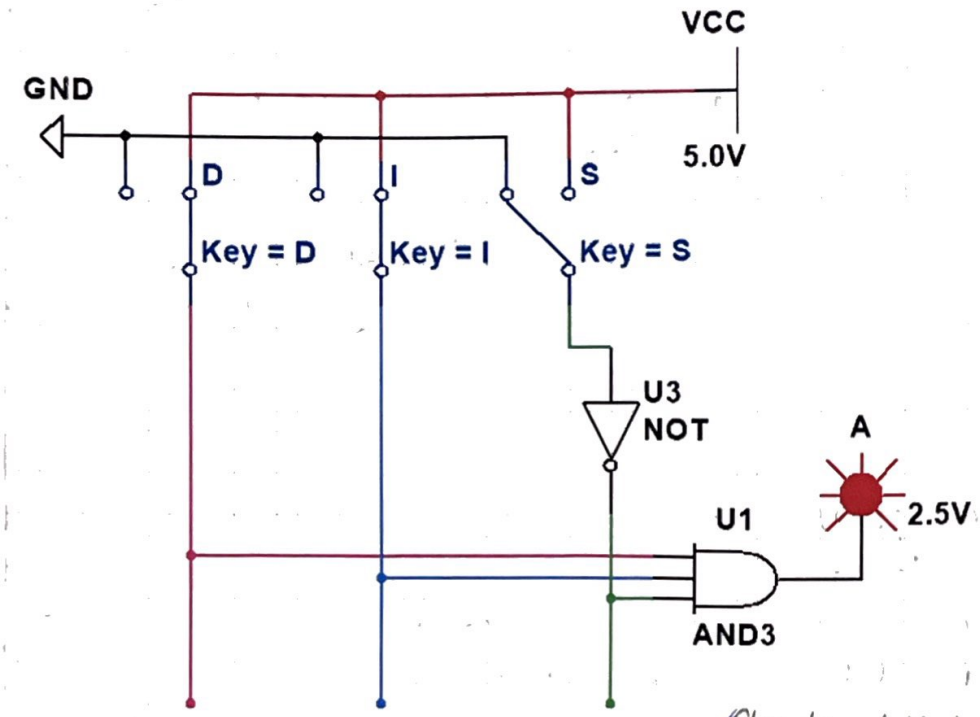
Simulation: Using Multisim, I built and tested the circuit.



I checked every input in the circuit and ✓ all the outputs matched the truth table.

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12/12/23

Build Notes:

- we used one 04 inverter chip and one 08 2 input AND chip ✓
- we powered and grounded both chips with the 5V and GND power holes
- we built on a MyDAQ board
- we connected the S0 switch to the inverter, representing the S variable
- we connected the S1 and S2 switches to the 2 input AND gate, representing the D and I variables
- we connected the output of the AND gate to another input on the AND gate, creating a 3 input AND gate
- we connected the inverter output to the other input on the AND gate ✓
- we connected the second AND gate output to the G1 LED hole
- we color-coded our wires, following the Multisim wire colors: D variable = S0 = red, I = S1 = blue, S = S2 = green
- our switches were in the same order as the variables in our truth table

chips always upright

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Test Notes: we did not test the circuit

Conclusion: We designed, simulated, and built a circuit that provided an alarm (probe) when the door sensor (D) was on (1), the ignition (I) was on (1), and the seat belt clip (S) was off (0). The alarm output matched the truth table when the circuit was tested in Multisim. While building the circuit on the MyDAQ board, we encountered a problem because we didn't ground the inverter chip or power the AND gate chip. After connecting the inverter to the 5V power and the AND chip to the GND hole, our circuit was completely wired and suitable for testing. If given more time, we would test our circuit to see if it was wired correctly and the alarm/LED went off when the designated switches were on. We could also redesign the circuit to account for weight detection in the car seats. This would add another variable, W, which would be true (1) when the weight is over a certain limit.

aw

19/20

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