

Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

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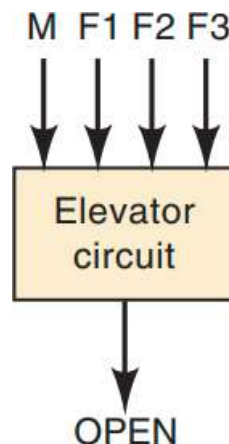
Project Guide: Dr. Maheswari. R

Title of the project:

Simple Elevator Door Controller for A Three-Story Building Using eSim

Theory:

This circuit would be a logic circuit that controls an elevator door in a three-storey building. The circuit has four inputs. M is a logic signal that indicates when the elevator is moving ($M = 1$) or stopped ($M = 0$). F1, F2, and F3 are floor indicator signals that are normally LOW, and they go HIGH only when the elevator is positioned at the level of that particular floor. For example, when the elevator is lined up level with the second floor, $F2 = 1$ and $F1 = F3 = 0$. The circuit output is the OPEN signal, which is normally LOW and will go HIGH when the elevator door is to be opened.



The truth table for the OPEN output can be derived as follows:

1. Because the elevator cannot be lined up with more than one floor at a time, only one of the floor inputs can be HIGH at any given time.
2. This means that all those cases in the truth table where more than one floor input is a 1 are don't-care conditions.
3. Place an 'X' in the OPEN output column for those eight cases where more than one F input is 1.
4. Looking at the other eight cases, when $M = 1$ the elevator is moving, so OPEN must be a 0 because the elevator door should not open.
5. When $M = 0$ (elevator stopped), OPEN = 1 is required, if one of the floor inputs is 1.
6. When $M = 0$ and all floor inputs are 0, the elevator is stopped but is not properly lined up with any floor, so output should be 'OPEN = 0' to keep the door closed.
7. The truth table is now complete and can be transferred to the K map.

Truth Table:

M	F1	F2	F3	OPEN
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	X
0	1	0	0	1
0	1	0	1	X
0	1	1	0	X
0	1	1	1	X
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	X
1	1	0	0	0
1	1	0	1	X
1	1	1	0	X
1	1	1	1	X

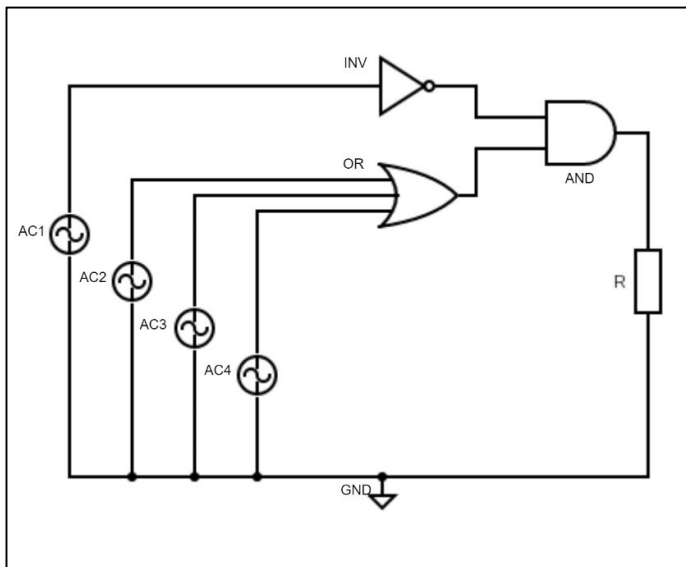
K-map:

The K-map for the Elevator Door Controller is shown below:

Map				
	$\overline{C}.D$	$\overline{C}.\overline{D}$	$C.D$	$C.\overline{D}$
$\overline{A}.\overline{B}$	0	1	x	1
$\overline{A}.B$	1	x	x	x
$A.B$	0	x	x	x
$A.\overline{B}$	0	0	x	0

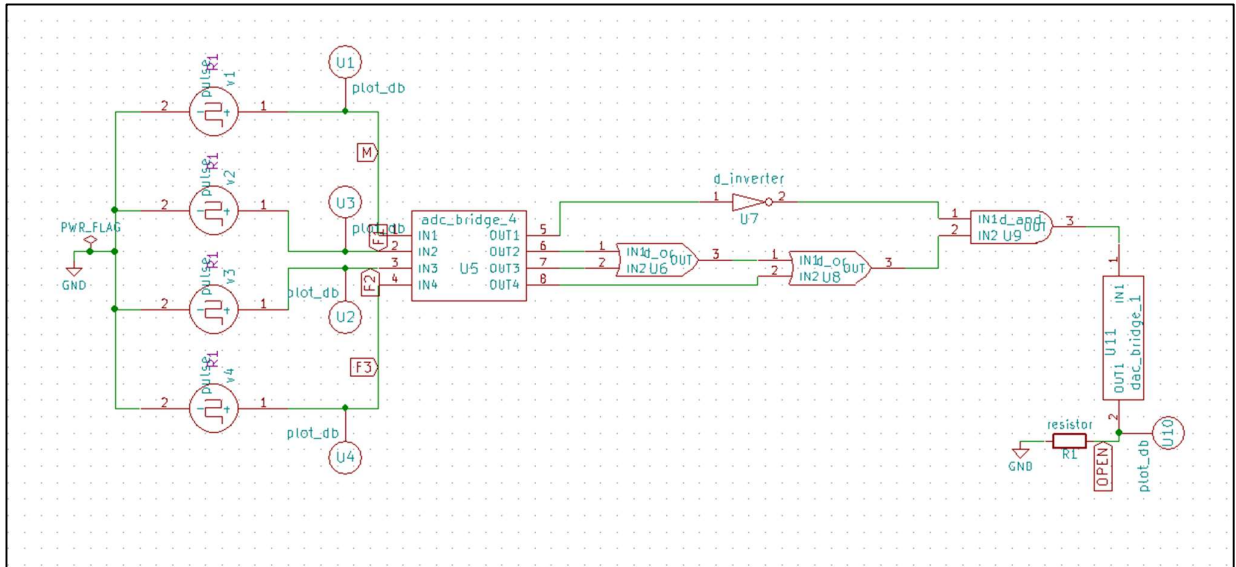
Circuit:

The circuit of the Elevator Door Controller is shown below:



Schematic in eSim:

The circuit schematic of the Elevator Door Controller in eSim is shown below:



Source and Analysis for Reference:

V1 and V2:

Analysis	Source Details	Ngspice Model	Device Modeling	Subcircuits
Add parameters for pulse source v1				
Enter initial value(Volts/Amps):				0
Enter pulsed value(Volts/Amps):				5
Enter delay time (seconds):				16
Enter rise time (seconds):				0
Enter fall time (seconds):				0
Enter pulse width (seconds):				16
Enter period (seconds):				32
Add parameters for pulse source v2				
Enter initial value(Volts/Amps):				0
Enter pulsed value(Volts/Amps):				5
Enter delay time (seconds):				8
Enter rise time (seconds):				0
Enter fall time (seconds):				0
Enter pulse width (seconds):				8
Enter period (seconds):				16

V3 and V4:

Analysis

Source Details

Ngspice Model

Device Modeling

Subcircuits

Add parameters for pulse source v3

Enter initial value(Volts/Amps):

0

Enter pulsed value(Volts/Amps):

5

Enter delay time (seconds):

4

Enter rise time (seconds):

0

Enter fall time (seconds):

0

Enter pulse width (seconds):

4

Enter period (seconds):

8

Add parameters for pulse source v4

Enter initial value(Volts/Amps):

0

Enter pulsed value(Volts/Amps):

5

Enter delay time (seconds):

2

Enter rise time (seconds):

0

Enter fall time (seconds):

0

Enter pulse width (seconds):

2

Enter period (seconds):

4

Analysis:

Analysis

Source Details

Ngspice Model

Device Modeling

Subcircuits

Select Analysis Type

☐ AC

☐ DC

☒ TRANSIENT

Transient Analysis

Start Time

0

Sec

Step Time

10

ms

Stop Time

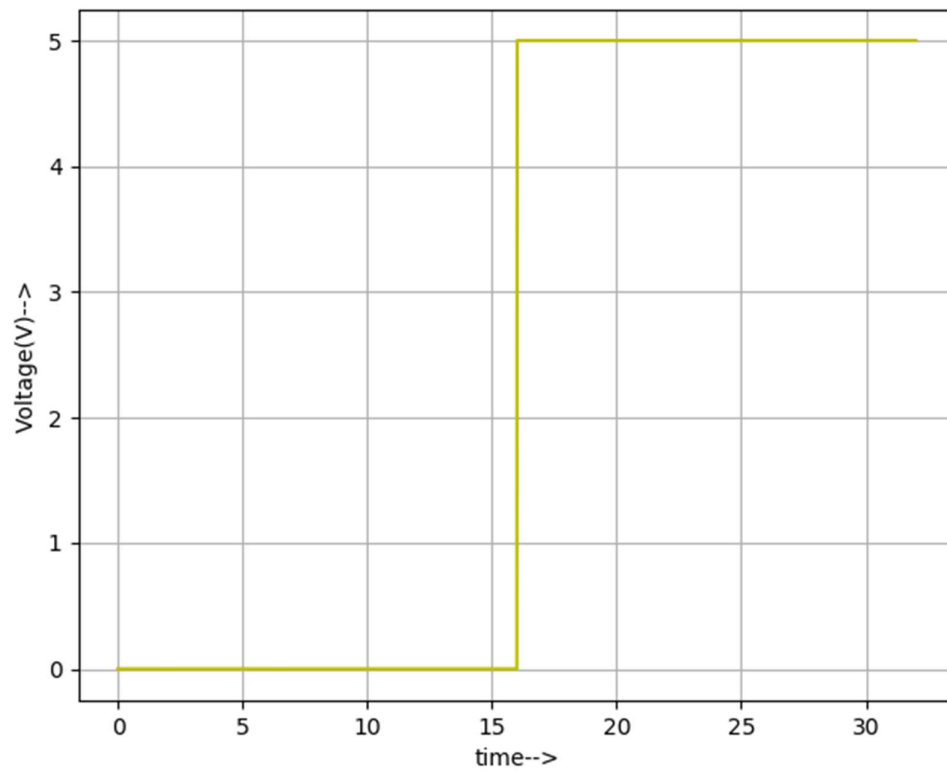
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Sec

Simulation Results for the Schematic:

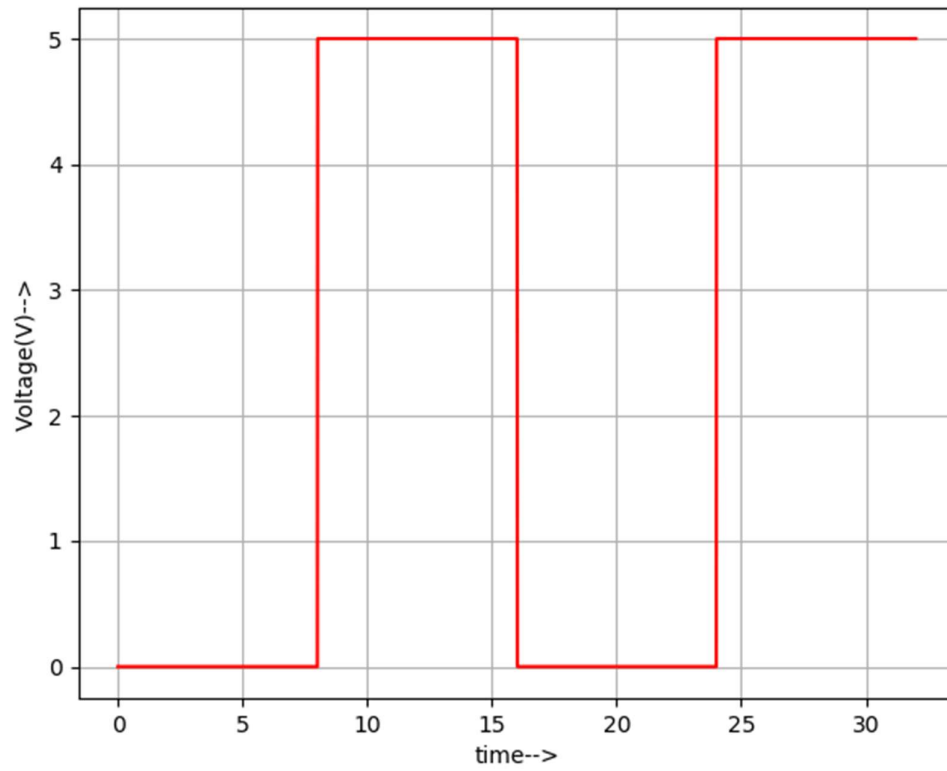
The input M:

The input for if the elevator is in motion or not.

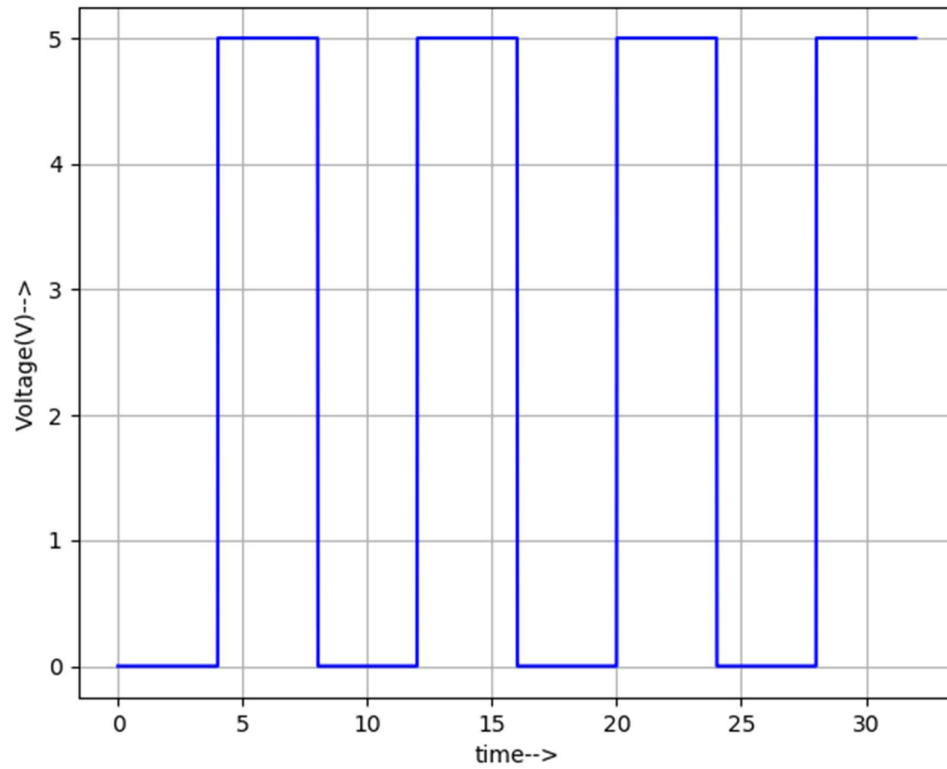


The input F1:

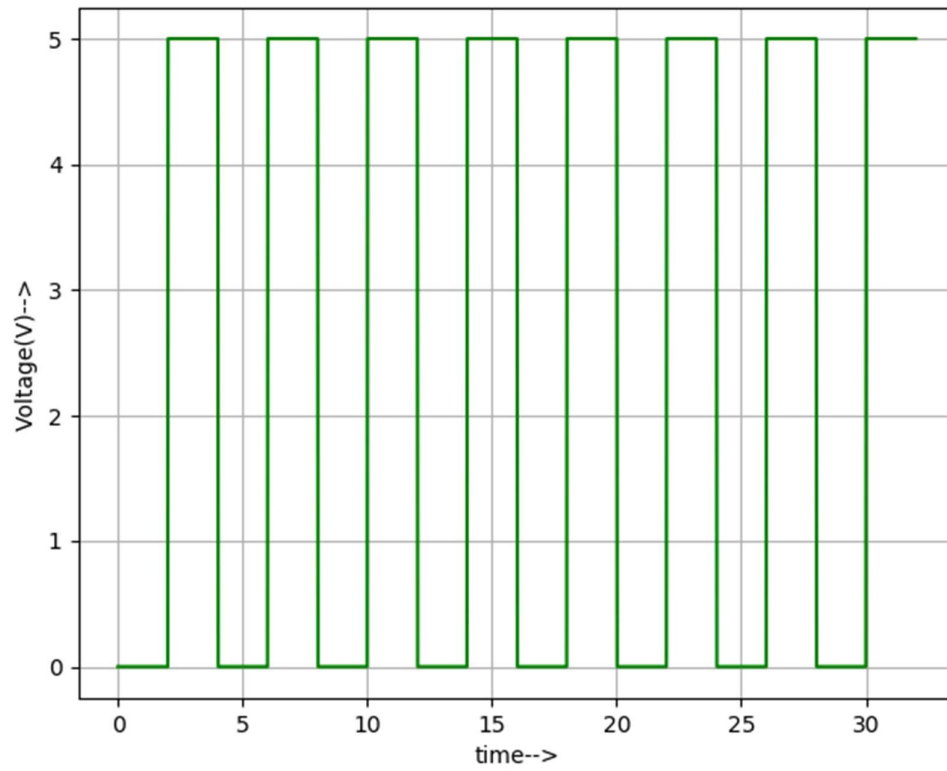
The input for the first floor.



The input F2:
The input for the second floor.

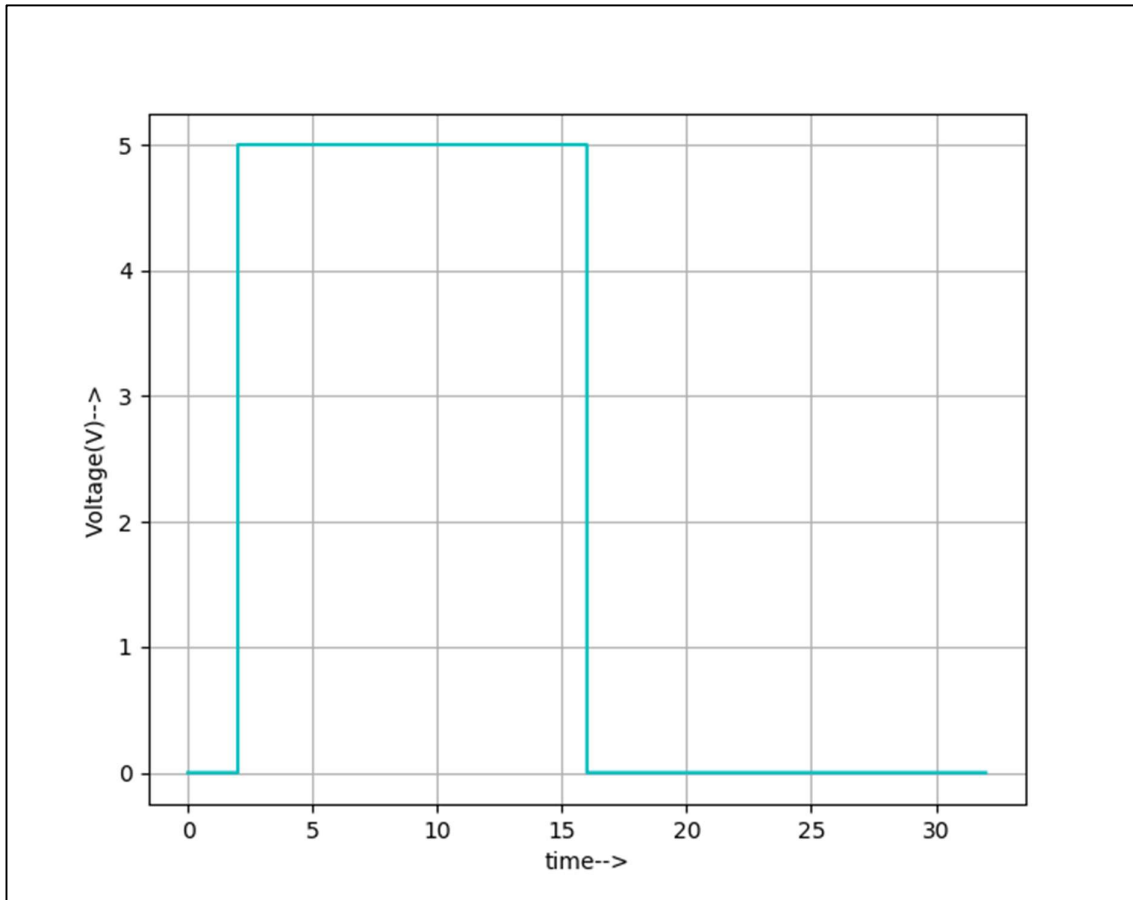


The input F3:
The input for the third floor.



The output OPEN:

The output which determines if the elevator door should open or not.



Conclusion:

Thus, the connection for the Elevator Door Controller was made in eSim and its truth table was verified from the simulations.

Reference:

<https://www.transtutors.com/questions/let-s-design-a-logic-circuit-that-controls-an-elevator-door-in-a-three-story-b-669559.htm>