Truth Table

Input					Output		
S_C	S_O	LDR	L_O	L_C	Forward	Reverse	Error
0	0	0	0	0	0	1	0
0	0	0	0	1	0	0	0
0	0	0	1	0	0	1	0
0	0	0	1	1	0	0	1
0	0	1	0	0	1	0	0
0	0	1	0	1	1	0	0
0	0	1	1	0	0	0	0
0	0	1	1	1	0	0	1
0	1	0	0	0	1	0	0
0	1	0	0	1	1	0	0
0	1	0	1	0	0	0	0
0	1	0	1	1	0	0	1
0	1	1	0	0	1	0	0
0	1	1	0	1	1	0	0
0	1	1	1	0	0	0	0
0	1	1	1	1	0	0	1
1	0	0	0	0	0	1	0
1	0	0	0	1	0	0	0
1	0	0	1	0	0	1	0
1	0	0	1	1	0	0	1
1	0	1	0	0	0	1	0
1	0	1	0	1	0	0	0
1	0	1	1	0	0	1	0
1	0	1	1	1	0	0	0
1	1	0	0	0	0	0	0
1	1	0	0	1	0	0	0
1	1	0	1	0	0	0	0
1	1	0	1	1	0	0	1
1	1	1	0	0	0	0	0
1	1	1	0	1	0	0	0
1	1	1	1	0	0	0	0
1	1	1	1	1	0	0	1

S_c → Slide Switch to close the curtain by the user input

S_o → Slide Switch to open the curtain by the user input

L_c → Limit Switch to indicate whether the curtain is close or not

L_o → Limit Switch to indicate whether the curtain is open or not

LDR → The sensor that determines whether the sun is shining or not

Forward → Motor movement to open the curtain

Reverse → Motor movement to close the curtain

Error → a LED that lights up when the two limit switches are on

Logic Design

1- Forward Equation:

Using SOP

$$Output = \overline{Sc}\,\overline{So}\,LDR\,\overline{Lo}\,\overline{Lc} + \overline{Sc}\,\overline{So}\,LDR\,\overline{Lo}\,Lc + \overline{Sc}\,So\,\overline{LDR}\,\overline{Lo}\,\overline{Lc} + \overline{Sc}\,So\,\overline{LDR}\,\overline{Lo}\,Lc + \overline{Sc}\,So\,LDR\,\overline{Lo}\,\overline{Lc} + \overline{Sc}\,So\,LDR\,\overline{Lo}\,Lc$$

Abbreviate the equation

$$\therefore\ Output = \overline{Sc}\,\overline{So}\,LDR\,\overline{Lo}\,(\overline{Lc} + Lc) + \overline{Sc}\,So\,\overline{LDR}\,\overline{Lo}\,(\overline{Lc} + Lc) + \overline{Sc}\,So\,LDR\,\overline{Lo}\,(\overline{Lc} + Lc)$$

$$\therefore\ Output = \overline{Sc}\,\overline{So}\,LDR\,\overline{Lo} + \overline{Sc}\,So\,\overline{LDR}\,\overline{Lo} + \overline{Sc}\,So\,LDR\,\overline{Lo}$$

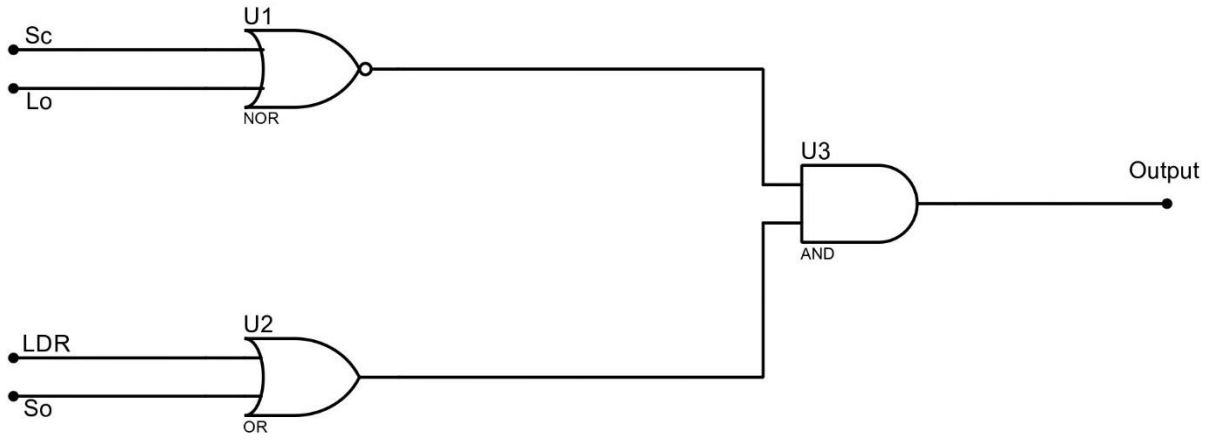
$$\therefore\ Output = \overline{Sc}\,\overline{Lo}\,(\overline{So}\,LDR + So\,\overline{LDR} + So\,LDR)$$

$$\therefore\ Output = \overline{Sc}\,\overline{Lo}\,(LDR\,(\overline{So} + So) + So\,\overline{LDR})$$

$$\therefore\ Output = \overline{Sc}\,\overline{Lo}\,(LDR + So\,\overline{LDR})$$

$$\therefore\ Output = \overline{Sc}\,\overline{Lo}\,(LDR + So)$$

$$\therefore\ Output = \overline{Sc + Lo}\,(LDR + So)\ \#$$



2- Reverse Equation:

Using SOP

$$Output = \overline{Sc}\,\overline{So}\,\overline{LDR}\,\overline{Lo}\,\overline{Lc} + \overline{Sc}\,\overline{So}\,\overline{LDR}\,Lo\,\overline{Lc} + Sc\,\overline{So}\,\overline{LDR}\,\overline{Lo}\,\overline{Lc} + Sc\,\overline{So}\,\overline{LDR}\,Lo\,\overline{Lc} + Sc\,\overline{So}\,LDR\,\overline{Lo}\,\overline{Lc} + Sc\,\overline{So}\,LDR\,Lo\,\overline{Lc}$$

Abbreviate the equation

$$\therefore\ Output = \overline{Sc}\,\overline{So}\,\overline{LDR}\,\overline{Lc}\,(\overline{Lo} + Lo) + Sc\,\overline{So}\,\overline{LDR}\,\overline{Lc}\,(\overline{Lo} + Lo) + Sc\,\overline{So}\,LDR\,\overline{Lc}\,(\overline{Lo} + Lo)$$

$$\therefore\ Output = \overline{Sc}\,\overline{So}\,\overline{LDR}\,\overline{Lc} + Sc\,\overline{So}\,\overline{LDR}\,\overline{Lc} + Sc\,\overline{So}\,LDR\,\overline{Lc}$$

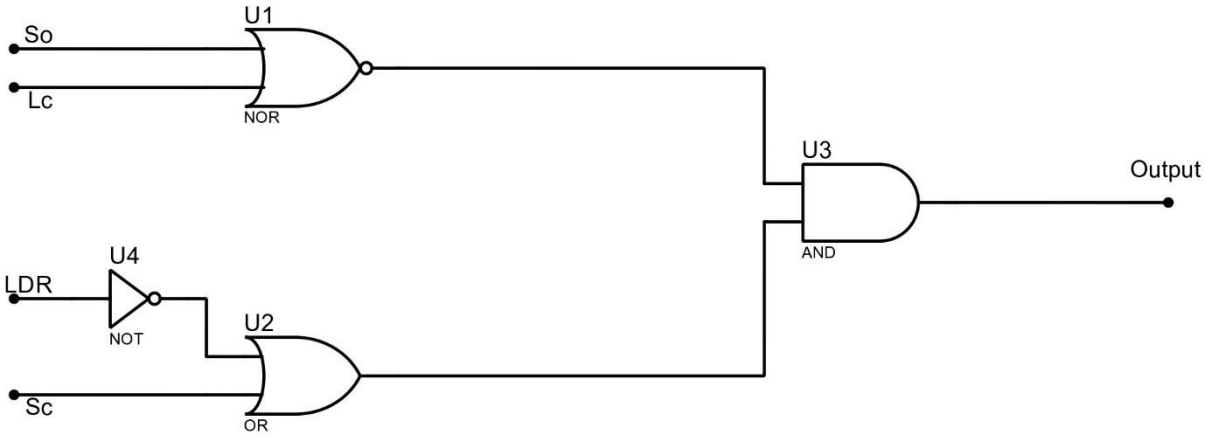
$$\therefore\ Output = \overline{So}\,\overline{Lc}\,(\overline{Sc}\,\overline{LDR} + Sc\,\overline{LDR} + Sc\,LDR)$$

$$\therefore\ Output = \overline{So}\,\overline{Lc}\,(\overline{LDR}\,(\overline{Sc} + Sc) + Sc\,LDR)$$

$$\therefore\ Output = \overline{So}\,\overline{Lc}\,(\overline{LDR} + Sc\,LDR)$$

$$\therefore\ Output = \overline{So}\,\overline{Lc}\,(\overline{LDR} + Sc)$$

$$\therefore\ Output = \overline{So + Lc}\,(\overline{LDR} + Sc)\ \#$$

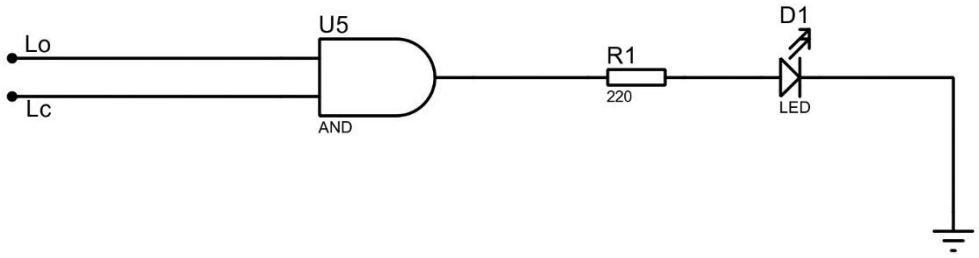


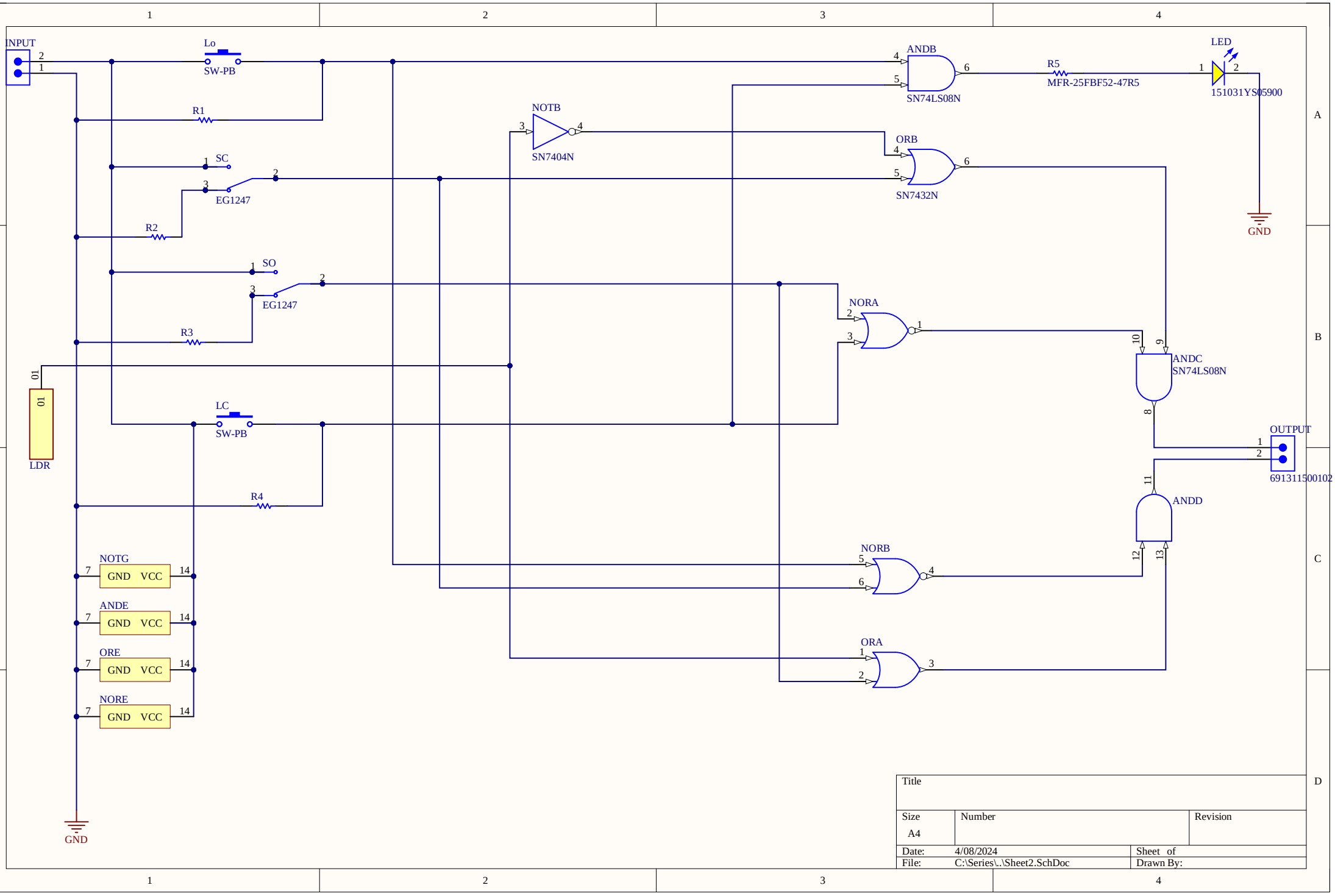
3- Error Equation:

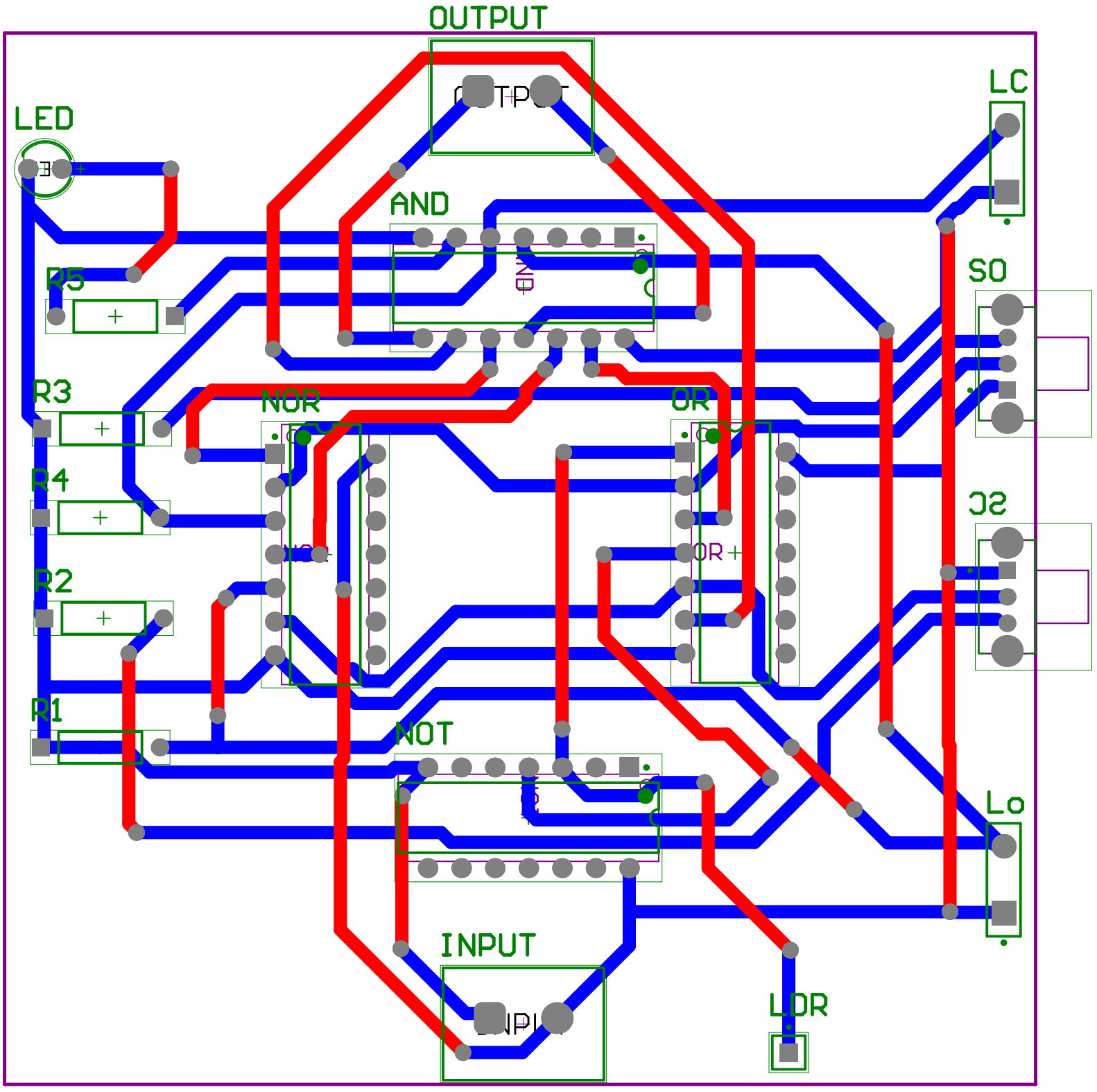
The error happens when the two limit switches are on and the motor stops in this case.

$\therefore The\ equation\ is$:

$Output = Lo\ .Lc$




INPUT
Lo
SW-PB
R1
SC
EG1247
R2
SO
EG1247
R3
LDR
LC
SW-PB
R4
NOTG
ANDE
ORE
NORE
GND VCC
GND
NOTB
SN7404N
ANDB
SN74LS08N
ORB
SN7432N
NORA
NORB
ORA
R5
MFR-25FBF52-47R5
LED
151031YS05900
GND
ANDC
SN74LS08N
ANDD
OUTPUT
691311500102
Title
Size
A4
Number
Revision
Date: 4/08/2024
Sheet of
File: C:\Series\..\Sheet2.SchDoc
Drawn By:


OUTPUT
LED
LC
AND
R5
SO
R3
NOR
OR
R4
J2
R2
R1
NOT
Lo
INPUT
LDR