***1. Project Name:*** *User and Self Controlled Land Rover(USLR)*

***2. Project Proposal:*** *User can control this rover by giving instruction through input. But if the rover detects any obstacle in front of it,it automatically changes its direction to avoid the obstacle. If there is no way out then it halts automatically. User can restart it after it stalls.*

***3.Specification of Input/ Ouput/Control Signal:*** *The rover can move to 3 direction:*

*Front,Right and Left. It Also Halts.*

*Here we are using 3 external input:*

*x,D0,D1.*

*x is the input we get from obstacle detector*

*If x=0 ,It detects no obstacle*

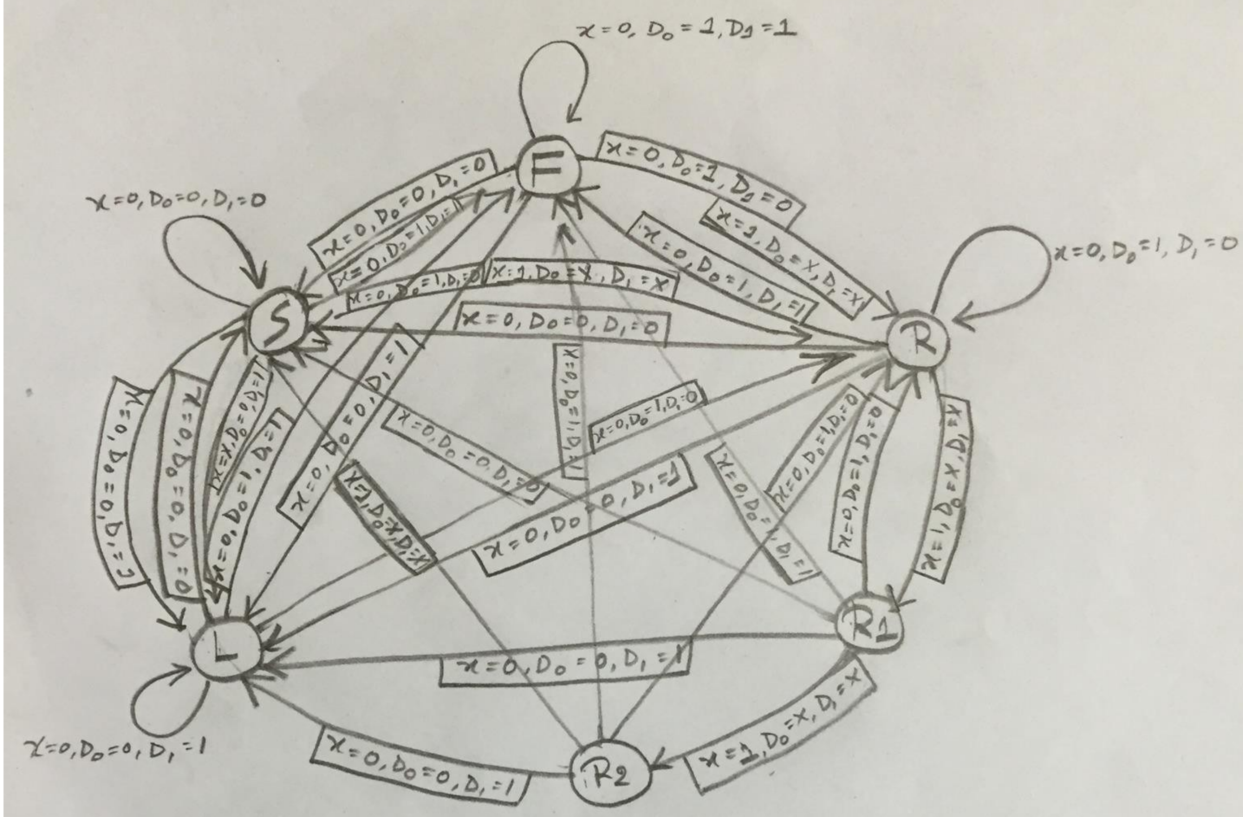
*If x=1,It detects obstacle*

*D0,D1 input is given by user. The Combinations are:*

| | D0 | D1 |
|---|---|---|
| Forward: | 1 | 1 |
| Right : | 1 | 0 |
| Left : | 0 | 1 |
| Stall : | 0 | 0 |

*The States used in State Diagram are*

| | | | |
|---|---|---|---|
| Forward: | 1 | 1 | 1 |
| Right : | 1 | 1 | 0 |
| Left : | 0 | 1 | 1 |
| Stall : | 0 | 0 | 0 |
| R1 : | 1 | 0 | 1 |
| R2: : | 0 | 1 | 0 |



State

| | | |
|---|---|---|
| Forward | : | 111 |
| Right | : | 110 |
| Left | : | 011 |
| Stall | : | 000 |
| $R_1$ | : | 101 |
| $R_2$ | : | 010 |

User input

| | | $D_0$ | $D_1$ |
|---|---|---|---|
| Forward | : | 1 | 1 |
| Right | : | 1 | 0 |
| Left | : | 0 | 1 |
| Break | : | 0 | 0 |

4.Truth Table:

| Previous | | | | Ext. Input | | | Next | | | | Flip-flops | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Symbol | A | B | C | D0 | D1 | x | A | B | C | Symbol | D(A) | D(B) | D(C) |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| S | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | L | 0 | 1 | 1 |
| S | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| S | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| S | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| S | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | F | 1 | 1 | 1 |
| S | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| XXXX | 0 | 0 | 1 | 0 | 0 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 0 | 0 | 1 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 0 | 1 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 0 | 1 | 1 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 1 | 0 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 1 | 0 | 1 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 1 | 1 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 0 | 0 | 1 | 1 | 1 | 1 | X | X | X | XXXX | X | X | X |
| R2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| R2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| R2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | L | 0 | 1 | 1 |
| R2 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| R2 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| R2 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| R2 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | F | 1 | 1 | 1 |
| R2 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| L | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| L | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| L | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | L | 0 | 1 | 1 |
| L | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| L | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| L | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| L | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | F | 1 | 1 | 1 |
| L | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| XXXX | 1 | 0 | 0 | 0 | 0 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 1 | 0 | 0 | 0 | 0 | 1 | X | X | X | XXXX | X | X | X |
| XXXX | 1 | 0 | 0 | 0 | 1 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 1 | 0 | 0 | 0 | 1 | 1 | X | X | X | XXXX | X | X | X |
| XXXX | 1 | 0 | 0 | 1 | 0 | 0 | X | X | X | XXXX | X | X | X |
| XXXX | 1 | 0 | 0 | 1 | 0 | 1 | X | X | X | XXXX | X | X | X |
| XXXX | 1 | 0 | 0 | 1 | 1 | 0 | X | X | X | XXXX | X | X | X |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| XXXX | 1 | 0 | 0 | 1 | 1 | 1 | X | X | X | XXXX | X | X | X |
| R1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| R1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | R2 | 0 | 1 | 0 |
| R1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | L | 0 | 1 | 1 |
| R1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | R2 | 0 | 1 | 0 |
| R1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| R1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | R2 | 0 | 1 | 0 |
| R1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | F | 1 | 1 | 1 |
| R1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | R2 | 0 | 1 | 0 |
| R | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| R | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | R1 | 1 | 0 | 1 |
| R | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | L | 0 | 1 | 1 |
| R | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | R1 | 1 | 0 | 1 |
| R | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| R | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | R1 | 1 | 0 | 1 |
| R | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | F | 1 | 1 | 1 |
| R | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | R1 | 1 | 0 | 1 |
| F | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | S | 0 | 0 | 0 |
| F | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| F | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | L | 0 | 1 | 1 |
| F | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| F | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| F | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |
| F | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | F | 1 | 1 | 1 |
| F | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | R | 1 | 1 | 0 |

*5.Simplification:*

K-Map:

D(A):

| ABC/D0<br>D1 x | 000 | 001 | 011 | 010 | 100 | 101 | 111 | 110 |
|---|---|---|---|---|---|---|---|---|
| 000 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| 001 | 1 | X | X | X | X | X | X | X |
| 011 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 010 | x | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 100 | 1 | x | x | x | x | x | x | x |
| 101 | x | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 111 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 110 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |

D(A) = D0x+BCD0+ABD0+A'B'x+A'B'D0+A'B'C+AB'C'+BCD1x'+ABD1x'+ABCx'

D(B) :

| ABC/D0 D1 x | 000 | 001 | 011 | 010 | 100 | 101 | 111 | 110 |
|---|---|---|---|---|---|---|---|---|
| 000 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 001 | X | X | X | X | X | X | X | X |
| 011 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 010 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 100 | x | x | x | x | x | x | x | x |
| 101 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 111 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 110 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |

D(B) = Bx+ D1x + D0x + Cx

D(C) :

| ABC/D0 D1 x | 000 | 001 | 011 | 010 | 100 | 101 | 111 | 110 |
|---|---|---|---|---|---|---|---|---|
| 000 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 001 | X | X | X | X | X | X | X | X |
| 011 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 010 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 100 | x | x | x | x | x | x | x | x |
| 101 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 111 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 110 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |

D(C) = D1x'+AC'x