AUTOMOTIVE DASHBOARD FUNCTIONS

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Contents

INTRODUCTION

In this project we will implement basic dashboard functions of a car.

The input signals are: Left turn indicating signal
Right turn indicating signal
Brake signal
Emergency signal
Parking signal

Inputs for Left indicator, right indicator and parking will be given on buttons situated in the steering wheel, while for brake is taken from brake paddle and for emergency input comes from emergency lever.

The output signals will be shown on: Dashboard (Left and Right)
Beside front head light (Left and Right)
Beside rear tail light (Left and Right)

We will first overview the implementation using logic gate circuit and then we will then use 8085 Microprocessor to program.

LOGIC GATES CIRCUIT

Here we need small voltage source for each of our inputs. These voltage sources are then connected to logic circuits via switch. If a button is it will complete the corresponding circuit and output is shown in accordance.

We will denote:

- Left turn indicator as LTURN
- Right turn indicator as RTURN
- Brake signal as BRAKE
- Emergency signal as EMERG
- Parking signal as PARK
- Output signal on Left side of dashboard as LDASH
- Output signal on Right side of dashboard as RDASH
- Output signal Left headlight indicator of dashboard as LFRONT
- Output signal Right headlight indicator of dashboard as RFRONT
- Output signal Left taillight indicator of dashboard as LREAR
- Output signal Rear taillight indicator of dashboard as RREAR

Now we will also use two pulse generator one with high frequency and other with low frequency. This will give better understanding of signals to nearby driver.

The table below shows the output signals when a button

INPUT					**OUTPUT**					
PARK	**BARKE**	**EMERG**	**LTURN**	**RTURN**	**LDASH**	**RDASH**	**LFORNT**	**RFRONT**	**LREAR**	**RREAR**
0	0	0	0	0	Off	Off	Off	Off	Off	Off
0	0	0	0	1	Off	Blink (Low freq.)	Off	Blink (Low freq.)	Off	Blink (Low freq.)
0	0	0	1	0	Blink (Low freq.)	Off	Blink (Low freq.)	Off	Blink (Low freq.)	Off
0	0	0	1	1	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.
0	0	1	0	0	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)
0	0	1	0	1	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)
0	0	1	1	0	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)

0	0	1	1	1	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.
0	1	0	0	0	Off	Off	Off	Off	On	On
0	1	0	0	1	Off	Blink (Low freq.)	Off	Blink (Low freq.)	On	Blink (Low freq.)
0	1	0	1	0	Blink (Low freq.)	Off	Blink (Low freq.)	Off	Blink (Low freq.)	On
0	1	0	1	1	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.
0	1	1	0	0	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)
0	1	1	0	1	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	On	Blink (Low freq.)
0	1	1	1	0	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	Blink (Low freq.)	On
0	1	1	1	1	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.	Blink (Low freq.
1	0	0	0	0	Off	Off	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	0	0	1	Off	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	0	1	0	Blink (Low freq.)	Off	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	0	1	1	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	1	0	0	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	1	0	1	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	1	1	0	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	0	1	1	1	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	0	0	0	Off	Off	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	0	0	1	Off	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)

1	1	0	1	0	Blink (Low freq.)	Off	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	0	1	1	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	1	0	0	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	1	0	1	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	1	1	0	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)
1	1	1	1	1	Blink (Low freq.)	Blink (Low freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)	Blink (High freq.)

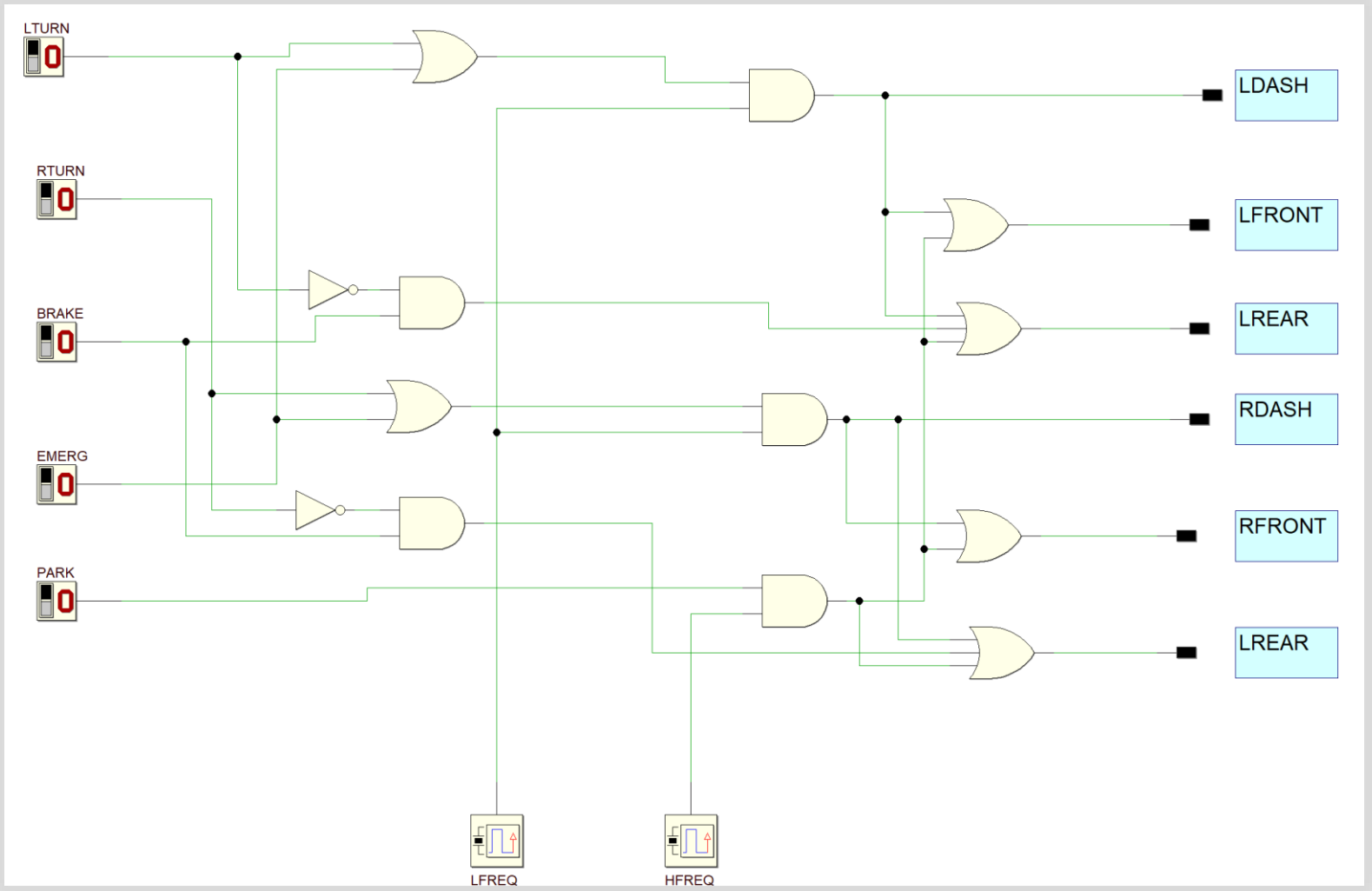
We can take some inferences

- LTURN and RTURN cannot be On at same time in real life, here we have assume to be On and controls each side fairly independently .
- If PARK = 1, then output of all will be blink with high frequency pulse on outside of vehicle, and LED will be on dashboard.
- If PARK = 0, signals on dashboard and beside front headlight are same as the dashboard signal gives driver the indication of what signal he is giving on front headlight.

Let high frequency oscillator be denoted as HFREQ and low frequency oscillator be LFREQ, then the output signals for following input signals be given as:

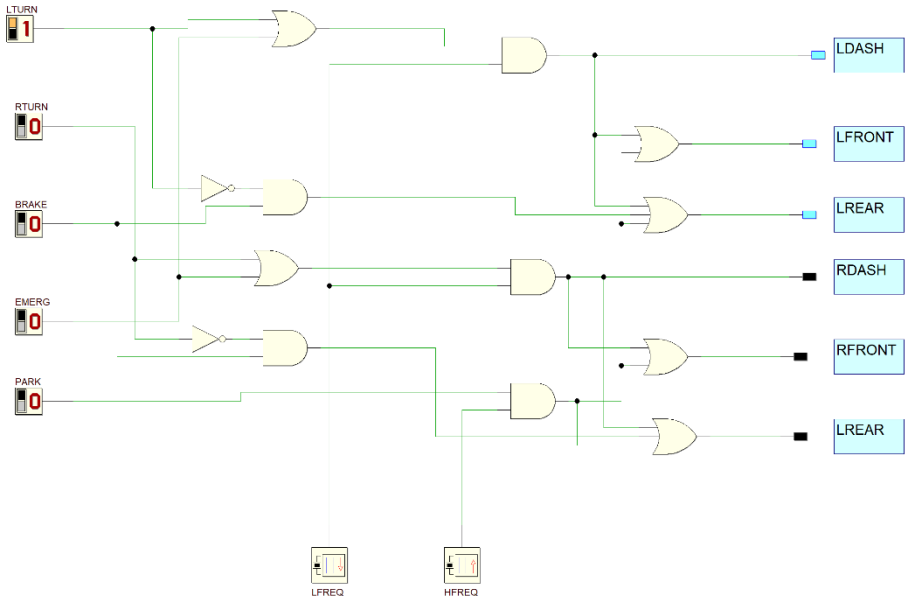
$LDASH = (LTURN + EMERG) \cdot LFREQ$
$LFRONT = (LTURN + EMERG) \cdot LFREQ + PARK \cdot HFREQ$
$LREAR = (LTURN + EMERG) \cdot LFREQ + \overline{LTURN} \cdot BRAKE + PARK \cdot HFREQ$
$RDASH = (RTURN + EMERG) \cdot LFREQ$
$RFRONT = (RTURN + EMERG) \cdot LFREQ + PARK \cdot HFREQ$
$RREAR = (RTURN + EMERG) \cdot LFREQ + \overline{RTURN} \cdot BRAKE + PARK \cdot HFREQ$

Now the logic gate circuit diagram of the circuit is given as:

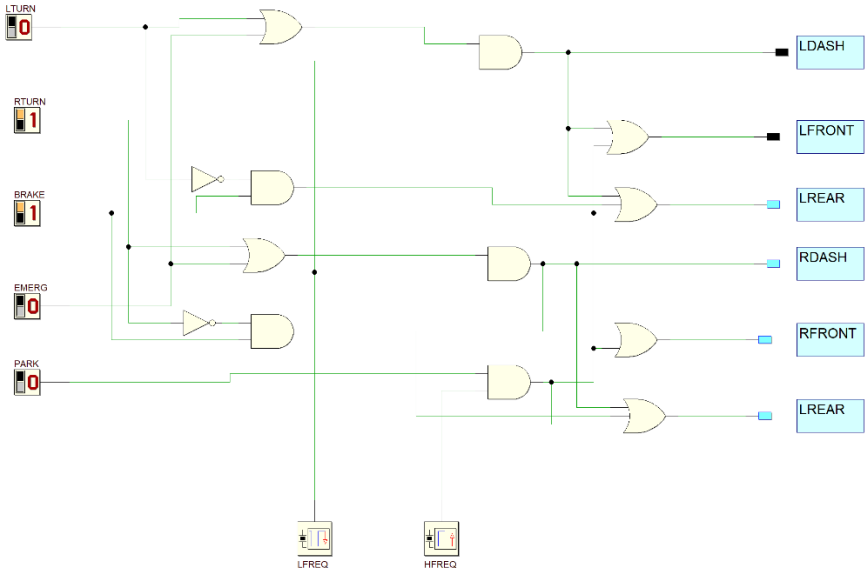

LTURN
RTURN
BRAKE
EMERG
PARK
LDASH
LFRONT
LREAR
RDASH
RFRONT
LREAR
LFREQ
HFREQ

Here is example of some of the situations while driving

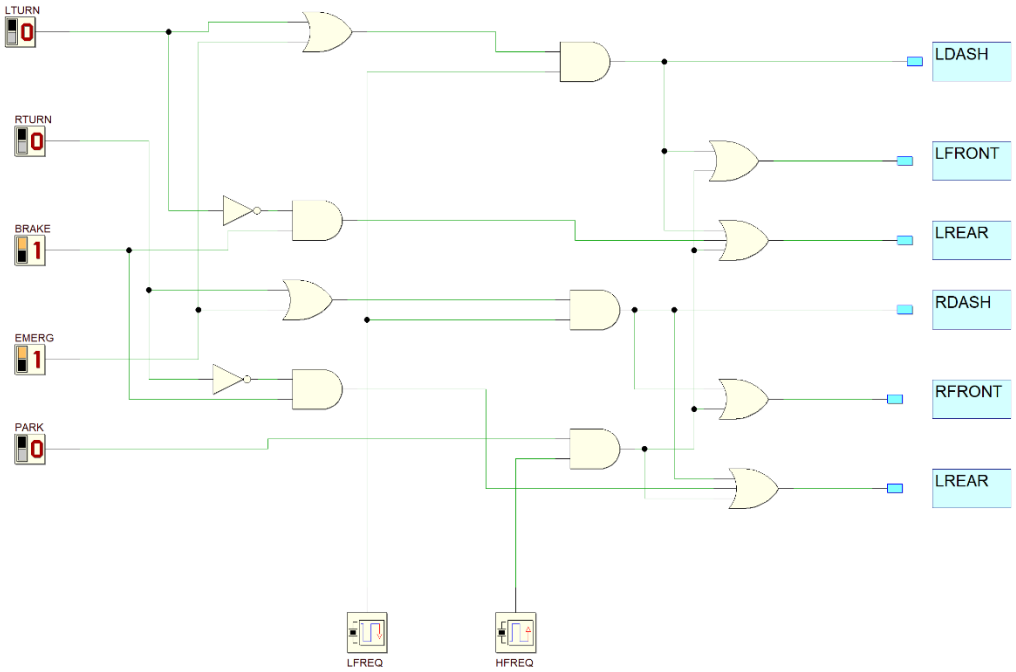
- When turning left on slow vehicle



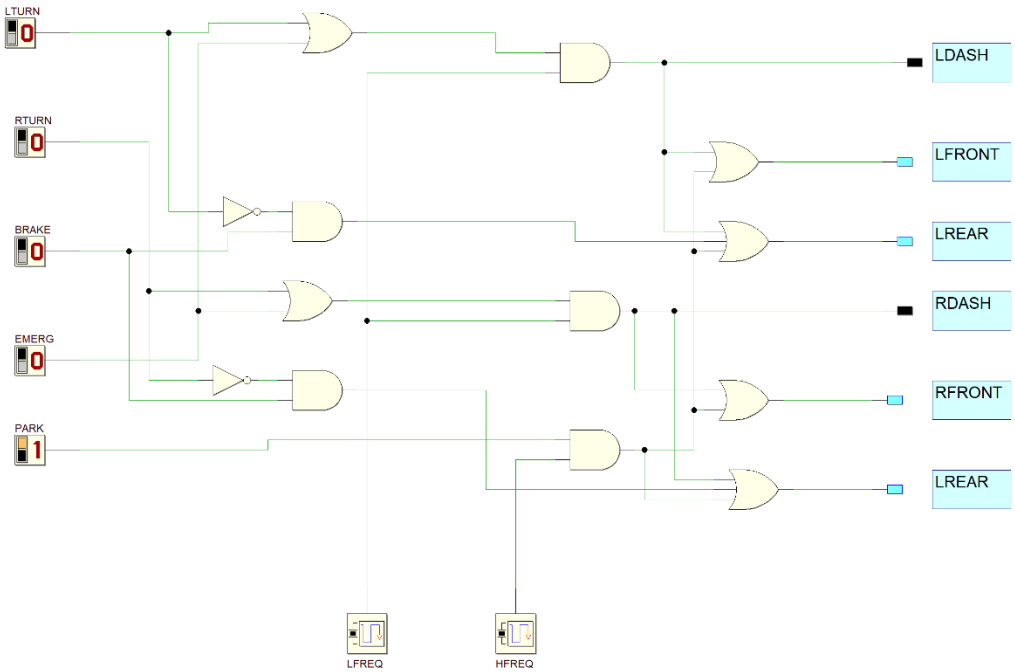
- When turning right on fairly fast vehicle (we also need to apply brake)



➢ We need to apply brake in emergency situation



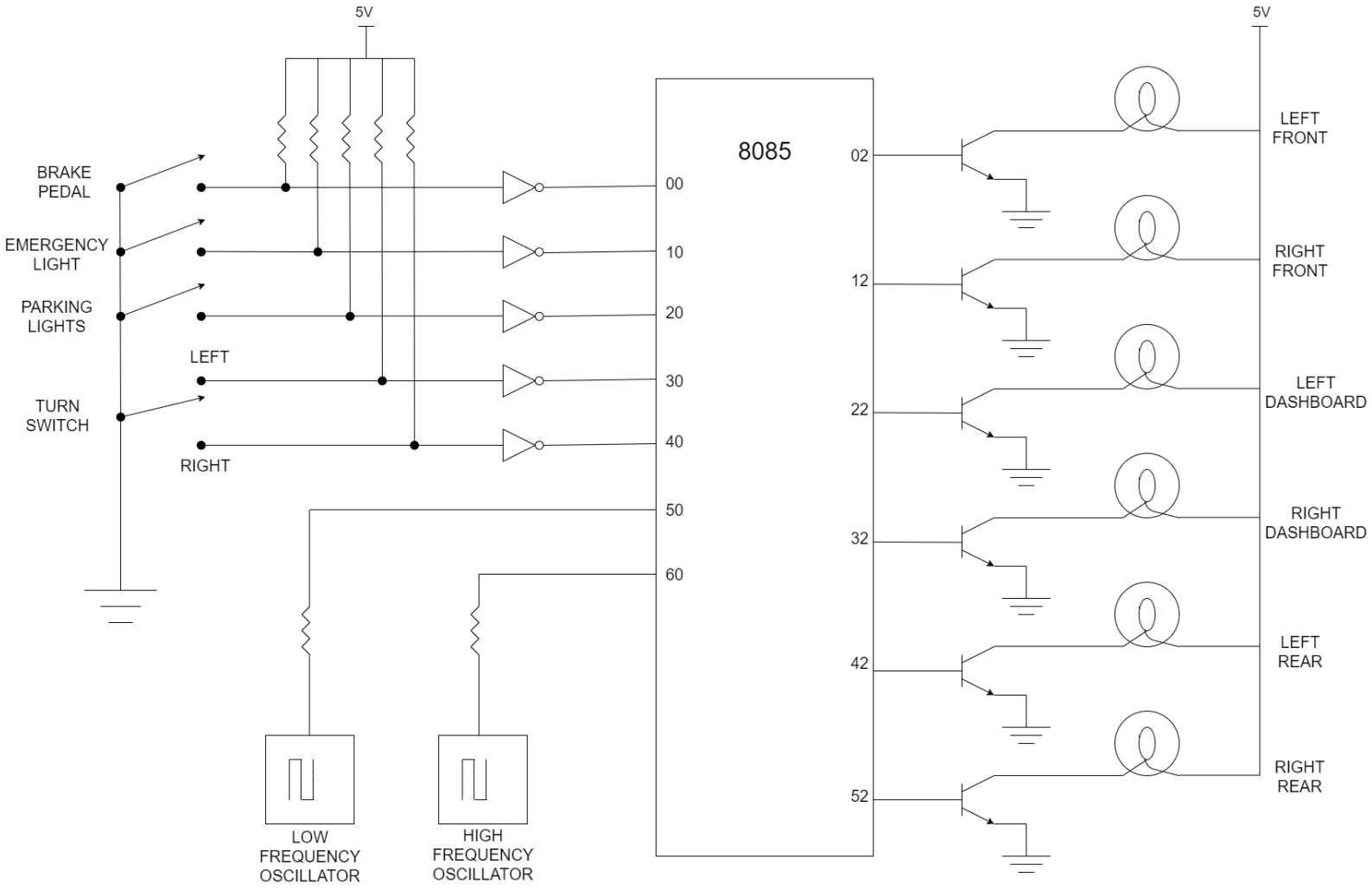
➢ When we are about to park a vehicle in a spot



And many more situations.

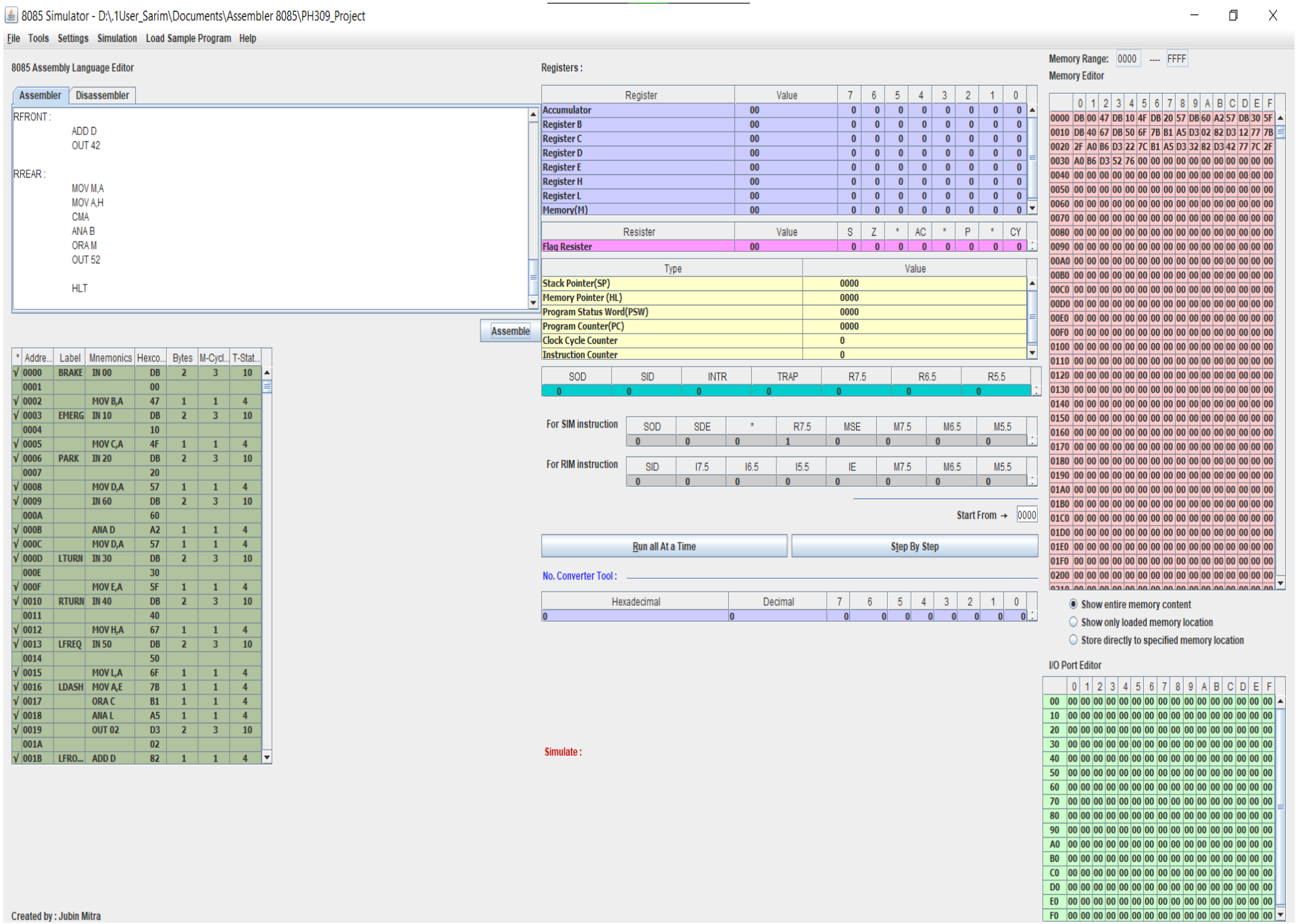
IMPLEMENTATION USING 8085 MICRPROCESSOR

Simplified diagram of input and output



We take inputs : 00 – Brake Pedal	We give Outputs : 02 – Left Front
10 – Emergency Light	12 – Right Front
20 – Parking Lights	22 – Left Dashboard
30 – Turn Switch for Left	32 – Right Dashboard
40 – Turn Switch for Right	42 – Left Rear
50 – Low frequency Oscillator	52 – Right Rear
60 – High frequency Oscillator	

For running the program, I used the 8085 simulator.



*	Addre...	Label	Mnemonics	Hexco...	Bytes	M-Cycl...	T-Stat...
√	0000	BRAKE	IN 00	DB	2	3	10
	0001			00			
√	0002		MOV B,A	47	1	1	4
√	0003	EMERG	IN 10	DB	2	3	10
	0004			10			
√	0005		MOV C,A	4F	1	1	4
√	0006	PARK	IN 20	DB	2	3	10
	0007			20			
√	0008		MOV D,A	57	1	1	4
√	0009		IN 60	DB	2	3	10
	000A			60			
√	000B		ANA D	A2	1	1	4
√	000C		MOV D,A	57	1	1	4
√	000D	LTURN	IN 30	DB	2	3	10
	000E			30			
√	000F		MOV E,A	5F	1	1	4
√	0010	RTURN	IN 40	DB	2	3	10
	0011			40			
√	0012		MOV H,A	67	1	1	4
√	0013	LFREQ	IN 50	DB	2	3	10
	0014			50			
√	0015		MOV L,A	6F	1	1	4
√	0016	LDASH	MOV A,E	7B	1	1	4
√	0017		ORA C	B1	1	1	4
√	0018		ANA L	A5	1	1	4
√	0019		OUT 02	D3	2	3	10
	001A			02			
√	001B	LFRO...	ADD D	82	1	1	4

Program:

Address	Label	Mnemonics	Hexcode	Bytes	Comments
0000H	BRAKE	IN 00	DB	2	First, we take input from brake pedal the pin 00 and copies it to Accumulator.
0001H			00		
0002H		MOV B,A	47	1	Now we copies input from Accumulator to Register B.
0003H	EMERG	IN 10	DB	2	Similarly we takes input from pin 10 and copies it to Accumulator.
0004H			10		
0005H		MOV C,A	4F	1	We copies input from Accumulator to Register C.
0006H	PARK	IN 20	DB	2	Takes input from pin 20 and copies it to Accumulator.
0007H			20		
0008H		MOV D,A	57	1	Copies input from Accumulator to Register D.
0009H		IN 60	DB	2	We takes input from pin 20 and copies it to Accumulator.(This is for high frequency oscillator.)
000AH			20		
000BH		ANA D	A2	1	And the content of A with content of Register D. (This is because in every output we takes output as PARK.HFREQ)
000CH		MOV D,A	57	1	Copies input from Accumulator to Register D.
000DH	LTURN	IN 30	DB	2	Takes input from pin 30 and copies it to Accumulator.
000EH			30		
000FH		MOV E,A	5F	1	Copies input from Accumulator to Register E.
0010H	RTURN	IN 40	DB	2	Takes input from pin 40 and copies it to Accumulator.
0011H			40		
0012H		MOV H,A	67	1	Copies input from Accumulator to Register H.
0013H	LFREQ	IN 50	DB	2	Takes input from pin 50 and copies it to Accumulator.(Here we take low frequency oscillator input.)
0014H			50		
0015H		MOV L,A	6F	1	Copies input from Accumulator to Register L.
0016H	LDASH	MOV A,E	7B	1	Copies input from Register E to Accumulator.
0017H		ORA C	B1	1	Or the contents of Accumulator with contents of Register C.
0018H		ANA L	A5	1	And the content of A with content of Register D.
0019H		OUT 02	D3	2	Copies the input from Accumulator to pin 02 for displaying output.

001AH			02		
001BH	LFRONT	ADD D	82	1	Add the contents of Register D to contents of Accumulator.
001CH		OUT 12	D3	2	Copies the input from Accumulator to pin 12 for displaying output.
001DH			12		
001EH	LREAR	MOV M,A	77	1	Copies input from Accumulator to Memory.
001FH		MOV A,E	7B	1	Copies input from Register E to Accumulator.
0020H		CMA	2F	1	Compliments the content of Accumulator.
0021H		ANA B	A0	1	And the content of A with content of Register B.
0022H		ORA M	B6	1	Or the contents of Accumulator with contents of Memory.
0023H		OUT 22	D3	2	Copies the input from Accumulator to pin 22 for displaying output.
0024H			22		
0025H	RDASH	MOV A,H	7C	1	Copies input from Register H to Accumulator.
0026H		ORA C	B1	1	Or the contents of Accumulator with contents of Register C.
0027H		ANA L	A5	1	And the content of A with content of Register D.
0028H		OUT 32	D3	2	Copies the input from Accumulator to pin 32 for displaying output.
0029H			32		
002AH	RFRONT	ADD D	82	1	Add the contents of Register D to contents of Accumulator.
002BH		OUT 42	D3	2	Copies the input from Accumulator to pin 42 for displaying output.
002CH			42		
002DH	RREAR	MOV M,A	77	1	Copies input from Accumulator to Memory.
002EH		MOV A,H	7C	1	Copies input from Register H to Accumulator.
002FH		CMA	2F	1	Compliments the content of Accumulator
0030H		ANA B	A0	1	And the content of A with content of Register B.
0031H		ORA M	B6	1	Or the contents of Accumulator with contents of Memory.
0032H		OUT 22	D3	2	Copies the input from Accumulator to pin 52 for displaying output.
0033H			52		
0034H		HLT		1	Halt the program

REFRENCES

1. Digital Principles And Applications edition by Donald P Leach, Albert Paul Malvino, Goutam Saha – 7th Edition
2. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S. Gaonkar- 5th Edition