CS684 Lab-1

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Assumptions made:

- ➔ All turns are at 90 degrees to the straight path, so my input value changes to 11100 or 00111 at the start of a turn
- ➔ Whenever robot encounters an intersection, it should take a respective turn instead of going straight
- ➔ The bot is perfectly centred in the start box so that once it exits it, we get input values of 00100 (straight path)

Strategy used:

I have defined a Mealy machine using 5 states:

- ➔ Start
- ➔ Go Straight
- ➔ Turn Left
- ➔ Turn Right
- ➔ Stop

My initial state will be the *Start* state. In the *Start* state, as long as my input remains 11111, i.e., i am inside the start box, i keep going forward (111). As soon as I exit the box, my input changes to 00100 and thus the machine transitions to the *Go Striaght* state, wherein we output 111 as long as input remains 00100.

Once we approach a turn, say left turn, since all turns are at 90 degrees, my input will change to 11100 at the start of the left turn. So, the machine transitions to the *Turn Left* state and outputs 101. Here, as long as the input is of the form X1X00 where 'X' is the don't care condition, I keep the output as 101 since at least one of the left White Line Sensors is high while the right ones are both low, which means the path is to the left of the bot. In the case where my inputs all turn low (00000), which means I have gone completely off the path and my last state was the *Turn Left* state, it means that I overshot to the left and thus need to perform a backward left adjust (output = 010).

SImilarly if I encounter a right turn, the input values change to 00111, and the machine transitions to the *Turn Right* state and outputs 110. Here, as long as the input is of the form 00X1X, I keep the output as 110 since at least one of the right White Line Sensors is high while the left ones are both low, which means the path is to the right of the bot. In the case where my inputs all turn low (00000), which

means I have gone completely off the path and my last state was the *Turn Right* state, it means that I overshot to the right and thus need to perform a backward right adjust (output = 001).

Once we complete a turn, the input values again change to 00100, machine transitions to the *Go Straight* state, and we output 111. We remain in this state till the input stays at 00100 and keep outputting 111. I have also added transitions between the *Turn Left* and the *Turn Right* states. In the odd case when my input values suddenly change to 00X1X while in the *Turn Left* state, machine transitions to the *Turn Right* state and outputs 110. Similarly if the input values suddenly change to X1X00 while in the *Turn Right* state, machine transitions to the *Turn Left* state and outputs 101.

Suppose the bot was on a straight path and suddenly encounters an input of 11111, i.e., we have reached the Stop box, we transition to the *Start* state and output 111. We stay in this state till all the input values are high and keep going straight. Once the bot exits the Stop box, we transition to the *Stop* state and go straight back (011). This is the final state of the machine.

Simulation:

Given below is the State Transition table generated using the Qfsm software:

States	Events										
	00000	**00010**	**00011**	**00100**	**00110**	**00111**	**01000**	**01100**	**11000**	**11100**	**11111**
Start	Stop	-	-	Go Straight	-	-	-	-	-	-	Start
Go Straight	-	Turn Right	Turn Right	Go Straight	Turn Right	Turn Right	Turn Left	Turn Left	Turn Left	Turn Left	Start
Turn Left	Turn Left	Turn Right	Turn Right	Go Straight	Turn Right	Turn Right	Turn Left	Turn Left	Turn Left	Turn Left	-
Turn Right	Turn Right	Turn Right	Turn Right	Go Straight	Turn Right	Turn Right	Turn Left	Turn Left	Turn Left	Turn Left	-
Stop	-	-	-	-	-	-	-	-	-	-	-

Given below are inputs used and the outputs used for performing the simulation:

Input	Current State	Next State	Output
Reset	-	Start	-
11111	Start	Start	111
00100	Start	Go Straight	111
11100	Go Straight	Turn Left	101
01100	Turn Left	Turn Left	101

01000	Turn Left	Turn Left	101
00000	Turn Left	Turn Left	010
00100	Turn Left	Go Straight	111
00111	Go Straight	Turn Right	110
00110	Turn Right	Turn Right	110
00010	Turn Right	Turn Right	110
01000	Turn Right	Turn Left	101
00010	Turn Left	Turn Right	110
00000	Turn Right	Turn RIght	001
00100	Turn Right	Go Straight	111
00100	Go Straight	Go Straight	111
11111	Go Straight	Start	111
11111	Start	Start	111
00000	Start	Stop	011
XXXXX	Stop	-	-

The link to the simulation video: https://youtu.be/V1vOMsowmZE