LabReport9

Arnav Yadnopavit- EE24BTECH11007
Prajwal- EE24BTECH11051

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Aim

To design and implement a Moore Finite State Machine (FSM) using T flip-flops to detect the overlapping sequence **11011**, and to analyze its state diagram, transition table, excitation equations, and output waveform.

Apparatus

- Logic simulator or breadboard setup
- Logic gates (AND, OR, NOT, XOR)
- T Flip-Flops (7476 ICs)
- Arduino
- LEDs for output
- Wires and connectors

Theory

Finite State Machines (FSM) are used to detect sequences. In a Moore machine, the output depends only on the present state.

Sequence to Detect: 11011 (Overlapping allowed)

States and Transitions

- S0: Initial state
- S1: Received '1'
- S2: Received '11'

- S3: Received '110'
- S4: Received '1101'
- S5: Sequence '11011' detected

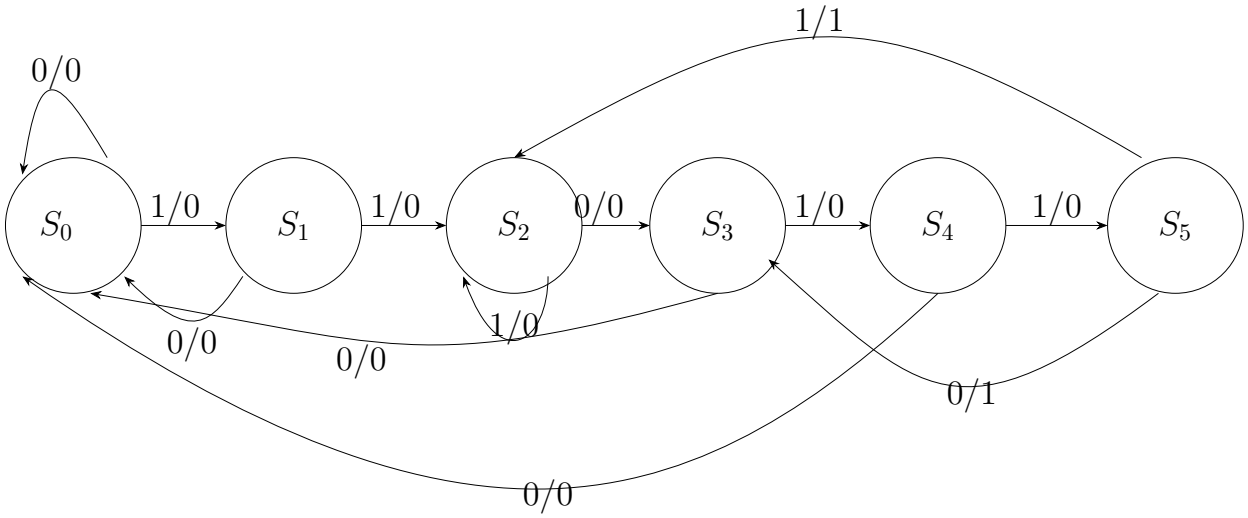


Figure 1: State Diagram

State Encoding

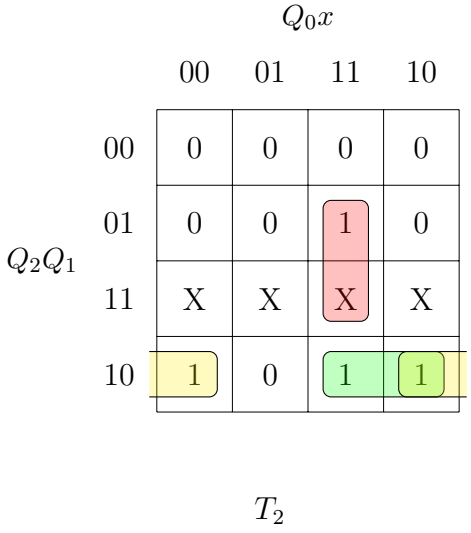
State	Encoding (Q2 Q1 Q0)
S0	000
S1	001
S2	010
S3	011
S4	100
S5	101

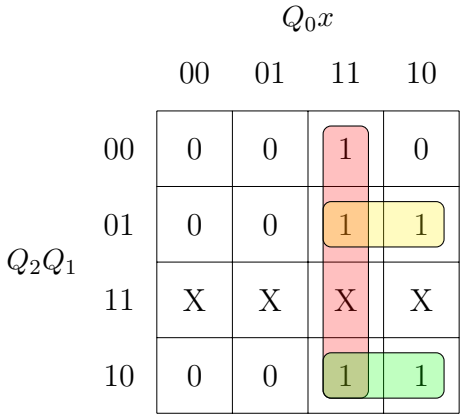
Output

- Output = 1 only in state S5
- Output = 0 in all other states

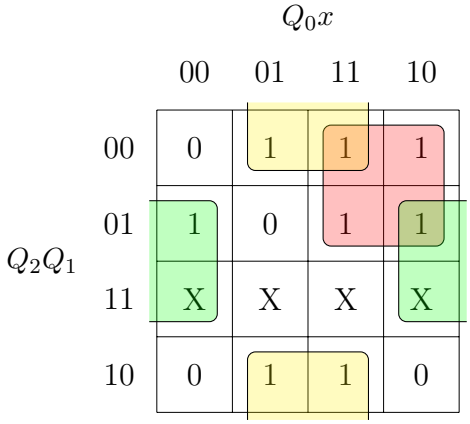
Finding Minterms

Q_2	Q_1	Q_0	x	T_2	T_1	T_0	Q_{2next}	Q_{1next}	Q_{0next}	y
0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	1	0	0	1	0
0	0	1	0	0	0	1	0	0	0	0
0	0	1	1	0	1	1	0	1	0	0
0	1	0	0	0	0	1	0	1	1	0
0	1	0	1	0	0	0	0	1	0	0
0	1	1	0	0	1	1	0	0	0	0
0	1	1	1	1	1	1	1	0	0	0
1	0	0	0	1	0	0	0	0	0	0
1	0	0	1	0	0	1	1	0	1	0
1	0	1	0	1	1	0	0	1	1	1
1	0	1	1	1	1	1	0	1	0	1
1	1	0	0	X	X	X	X	X	X	X
1	1	0	1	X	X	X	X	X	X	X
1	1	1	0	X	X	X	X	X	X	X
1	1	1	1	X	X	X	X	X	X	X





T_1

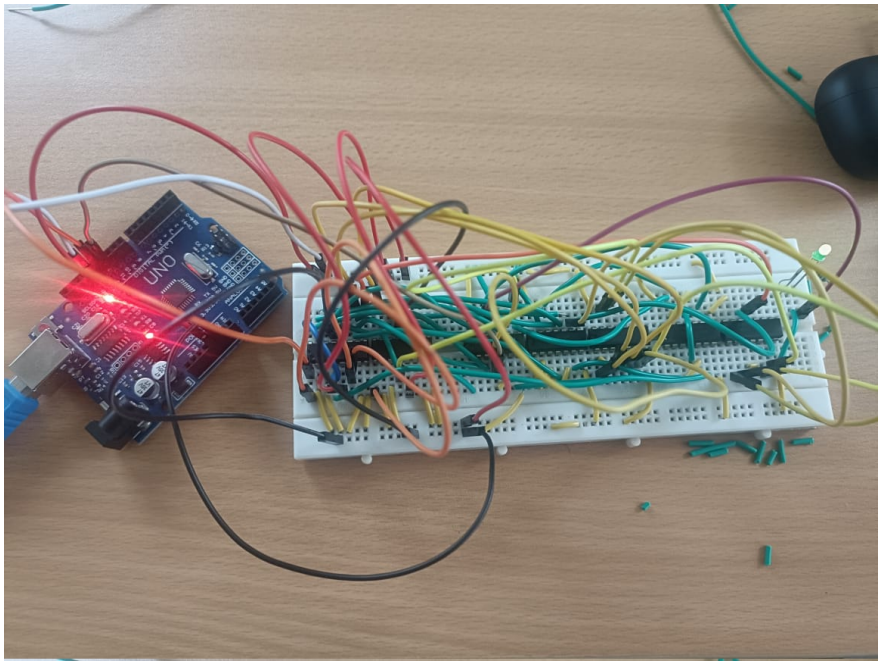


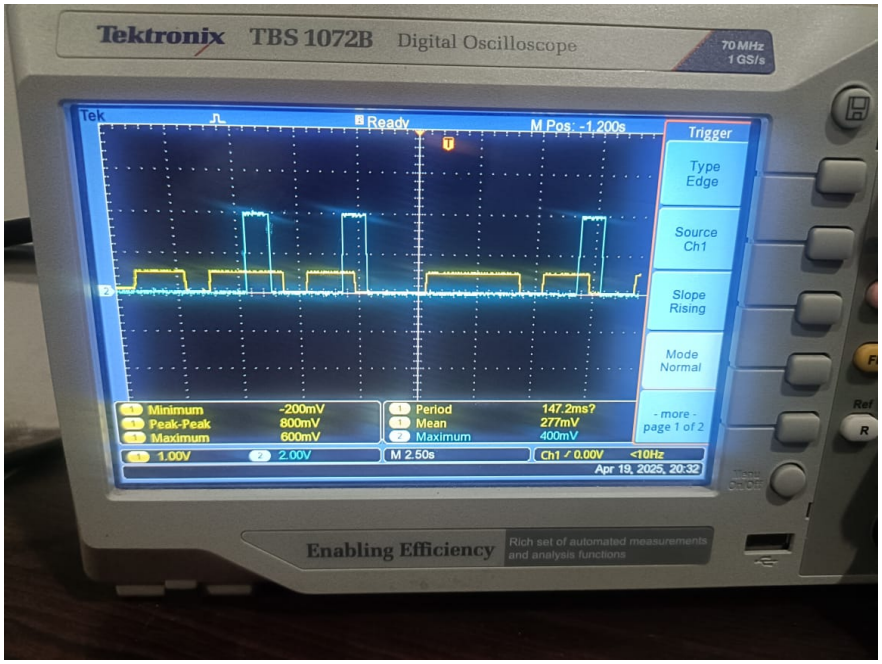
T_0

Expressions are as follows

$$T_2 = Q_1Q_0x + Q_2Q_1'Q_0 + Q_2Q_1'x'$$
$$T_1 = Q_0x + Q_2'Q_1Q_0 + Q_2Q_1'Q_0$$
$$T_0 = Q_1'x + Q_1x' + Q_0Q_2'$$
$$y = Q_2Q_1'Q_0$$

Observations





Result

The FSM successfully detects the sequence **11011** and produces an output '1' whenever the sequence is detected, including overlapping instances.
To refer arduino code and working video refer to

https://github.com/ArnavYadnopavit/ElectricalLabEE1200/tree/main/LabReport9
Thank you