RTL_EXERCISE_1 BOUND FLASHER

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Date	5/3/2024
Version	1.1

Contents

1. Interface

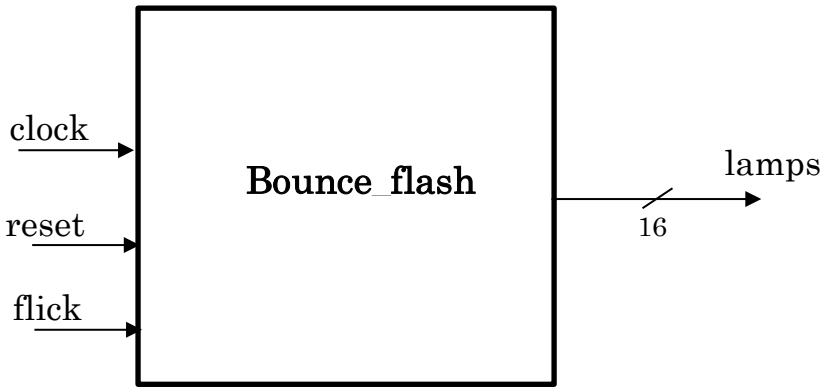


Figure 1: the figure of Bound Flasher System

Signal	Width	In/Out	Description
Clock	1	In	The clock signal that drives the state changes and timing within the module. Typically connected to the system clock.
Reset	1	In	Active-low reset signal. When asserted (0), it initializes the module's state to INIT and resets the lamps and lamp_counter.
Flick	1	In	Input signal used to trigger specific lamp behavior. When asserted (1), it activates flicker logic affecting the current lamp pattern.
lamps	16	Out	Output signal representing the state of 16 lamps. Each bit corresponds to a lamp, where 1 indicates on and 0 indicates off.

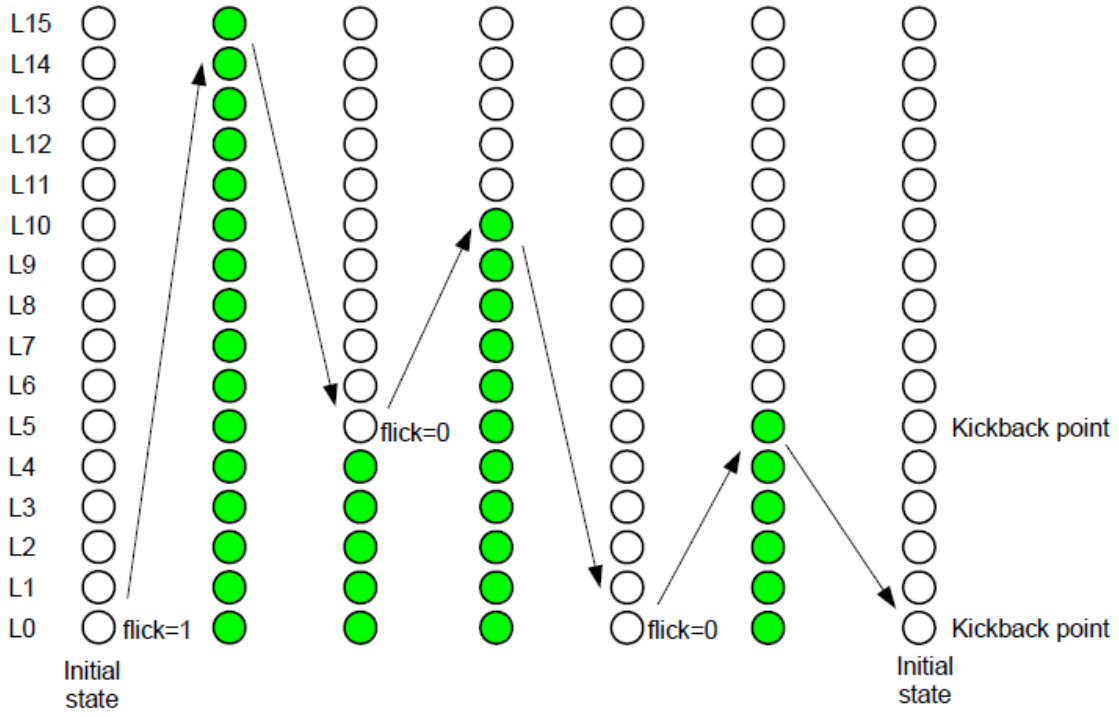
Table 1: Description of signals in Bound Flasher

2. Functional implementation.

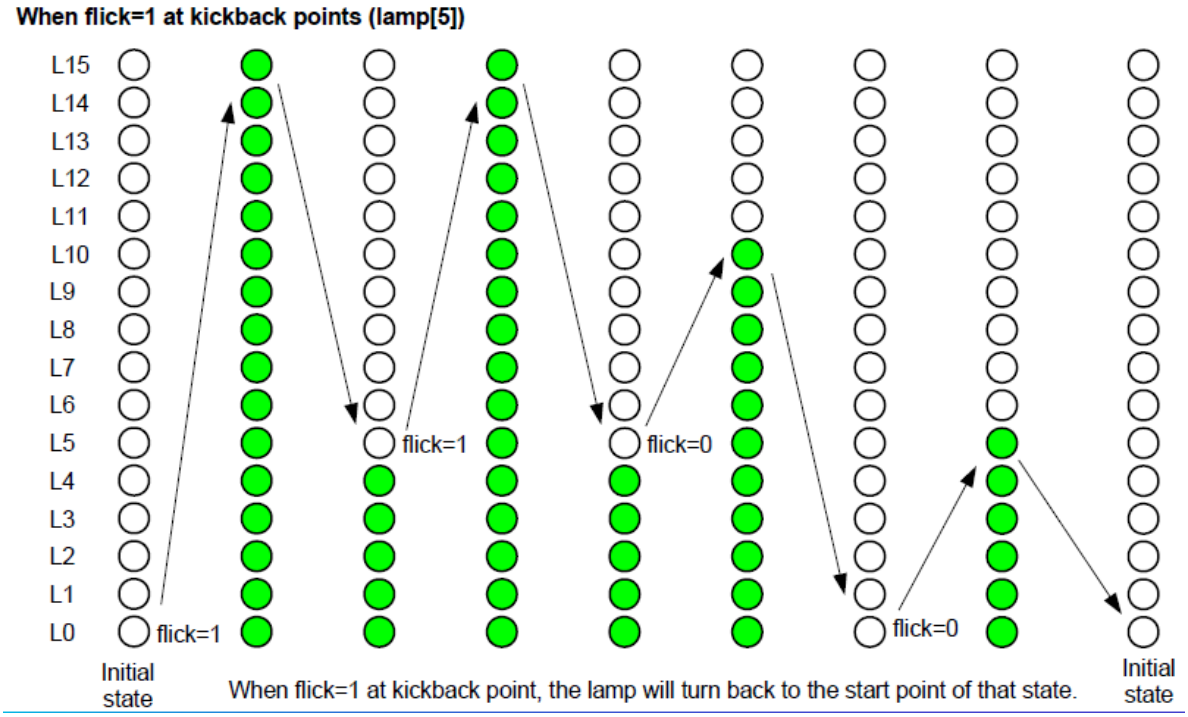
- Implement a 16-bits LEDs system
- System's Operation base on three input signal
  - Reset
  - Clock
  - Flick
- The system specification
  - Clock signal is provided for system inspire of function status. The function operate state's transition at positive edge of the clock signal.
  - Reset signal:
    - LOW-ACTIVE Reset = 0: System is restarted to Initial State.
    - HIGH-ACTIVE Reset = 1: System is started with initial state.
- Flick signal: special input for controlling state transfer.
- At the initial state, all lamps are OFF. If flick signal is ACTIVE, the flasher start operating:
  - The lamps are turned ON gradually from LEDs [0] to LEDs [15].
  - The LEDSs are turned OFF gradually from LEDs [15] to LEDs [5].
  - The LEDSs are turned ON gradually from LEDs [5] to LEDs [10].
  - The LEDSs are turned OFF gradually from LEDs [10] to LEDs [0].
  - The LEDSs are turned ON gradually from LEDs [0] to LEDs [5].
  - Finally, the LEDs s are turned OFF gradually from LEDSs [5] to LEDSs [0], return to initial state.
- Additional condition: At each kickback point (LEDs [5] and LEDs [0]), if flick signal is ACTIVE, the LEDs will go back and repeat that STATE. For simple, kickback point is considered only when the LEDs s are turned OFF gradually, except final state.

– Some insulations:

- When flick = 0 at kickback points



- When flick = 1 at kickback points (lamp[5])



3. Internal implementation.

3.1. Overall.

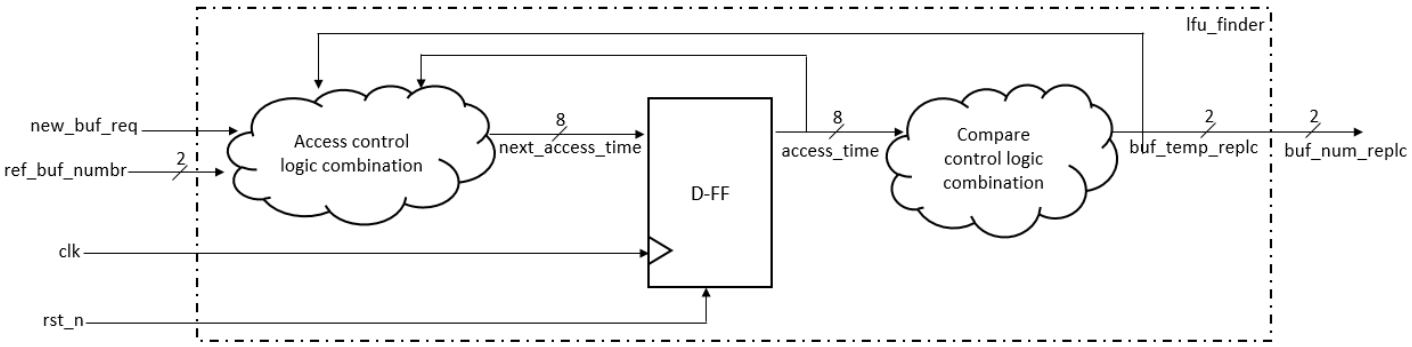


Figure 3.1: Block diagram of Bound Flasher

Signal	Width	In/Out	Description
new_buf_req	1	In	Signal to request a new buffer.
ref_buf_numbr	2	In	Reference buffer number input signal.
clk	1	In	The clock signal that drives the state changes and timing within th
rst_n	1	In	Active-low reset signal. When asserted (0), it initializes the module
next_access_time	8	Out	Next access time output from access control logic combination.
access_time	8	Out	Access time output from D-FF component after processing next_a
buf_temp_replc	2	Out	Buffer template replacement output after comparison in control lo combination.
buf_num_replc	2	Out	Buffer number replacement output after comparison in control log combination.

Table 3.1: Block diagram of Bound Flasher Description

3.2. State Machine

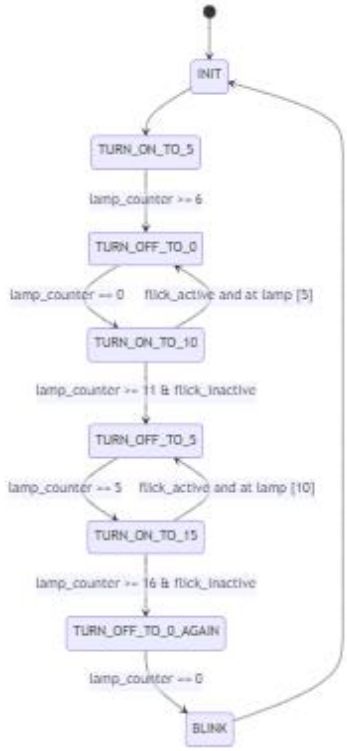


Figure 3.2: State Machine of Bound Flasher

Variable Name	Description
current_state	Holds the current state of the state machine.
next_state	Intended to hold the next state (not used in the provided code).
flick_active	A flag to indicate if the flick signal has been activated.
lamp_counter	A counter to keep track of the current lamp pattern.

Table 3.2: variable name of State machine

State Name	Description
`INIT`	Initial state where all lamps are turned off. The system transitions to `TURN_ON_TO_5` next.
`TURN_ON_TO_5`	Lamps are sequentially turned on from 0 to 5. After reaching 5, transitions to `TURN_OFF_TO_0`.
`TURN_OFF_TO_0`	Lamps are sequentially turned off from 5 to 0. After all are off, transitions to `TURN_ON_TO_10`.
`TURN_ON_TO_10`	Lamps are sequentially turned on from 0 to 10. If `flick` is activated at lamp 5, it flicks before continuing. After reaching 10, transitions to `TURN_OFF_TO_5`.
`TURN_OFF_TO_5`	Lamps are sequentially turned off from 10 to 5. After reaching 5, transitions to `TURN_ON_TO_15`.
`TURN_ON_TO_15`	Lamps are sequentially turned on from 5 to 15. If `flick` is activated at lamp 10, it flicks before continuing. After reaching 15, transitions to `TURN_OFF_TO_0_AGAIN`.
`TURN_OFF_TO_0_AGAIN`	Lamps are sequentially turned off from 15 to 0. After all are off, transitions to `BLINK`.
`BLINK`	All lamps are turned on, then all are turned off after a brief moment. The system then resets to `INIT`.

Table 3.3: state name of State machine

4. History

Date	Author	Modified part	Description
2017/03/28		All	New creation