

Food Dispenser

ELEC 402: System Verilog FSM Project

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FSM Description:

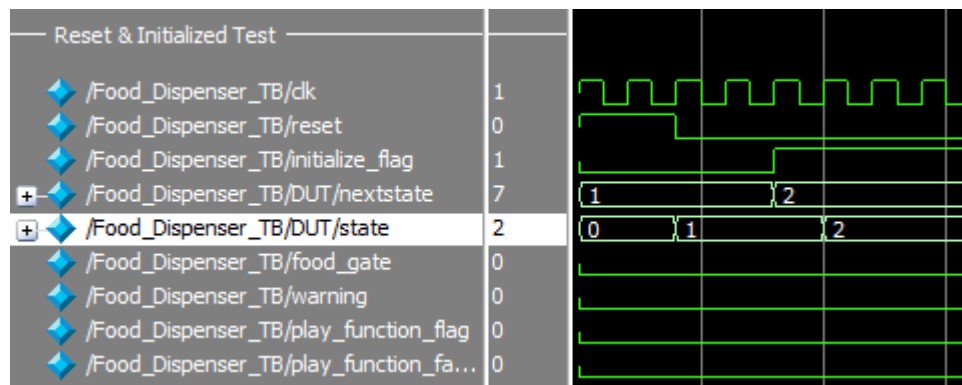
The food dispenser is designed for pets which has automatic functions controlled by a user interface. This FSM will function as the main FSM for the design. It includes automatic feeding, warning when pets don't finish their allotted food, playground function for pets, warning when food in bank is not enough etc. It first waits for user to set the daily feeding amount and the timer. Once that's settled, the food dispenser will feed the pet for specific amount at the set time. If the pet does not eat at least $\frac{2}{3}$ of the food in one complete timer cycle, FSM will send warning to user. There will be a playground function build into the food dispenser. When the play button/pedal is pressed, 1g of food will be released as reward, however, this function can only be triggered 15 times in one day. When there is not enough food in the bank, refill mode will trigger and until the bank is filled with at least one feeding cycle with the cap close, the FSM will not continue.

Testbench:

The testbench will simulate reset and initialization stage first, and then refill stage, playground function stage, and lastly automatic feeding stage. In each stage there will be different output depending on input flags, and testbench will simulate the flag and get the output result.

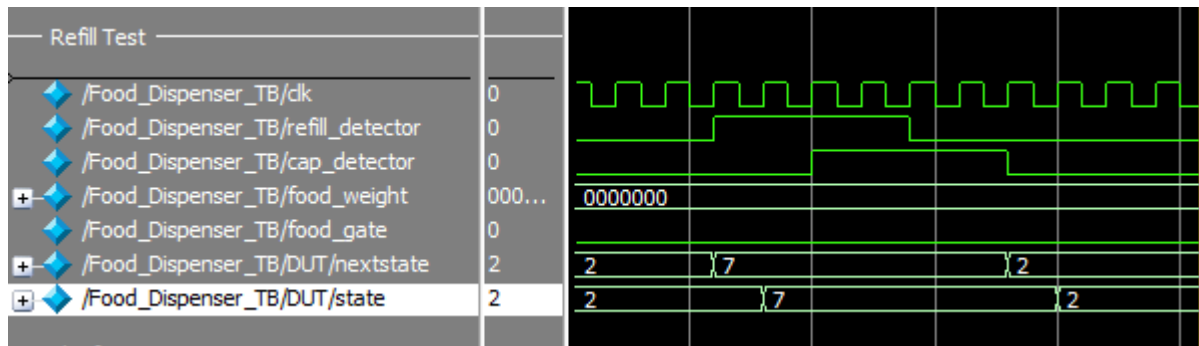
Simulation Waveforms:

Reset and Initialization State:



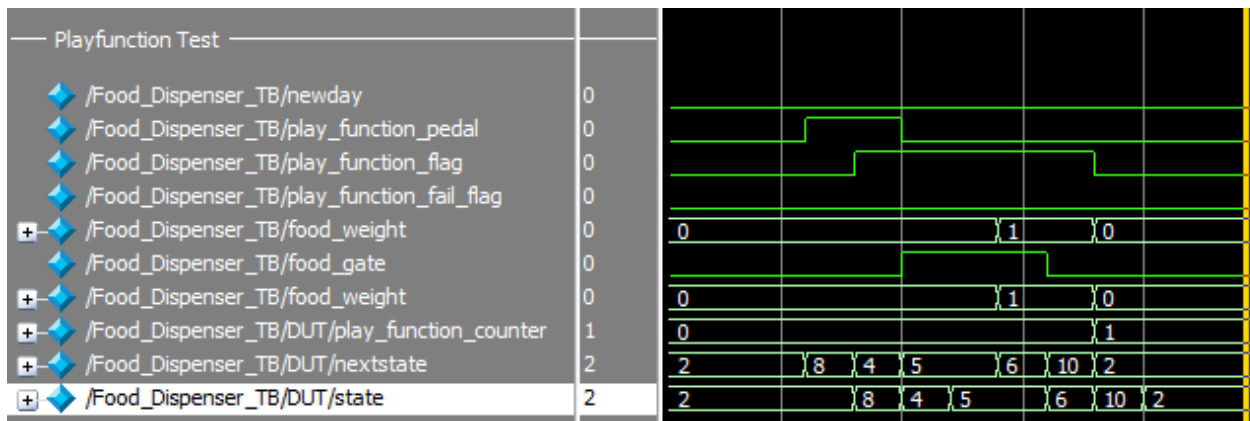
As seen in the figure, high reset signal will set the state to zero (initialization state) which set all output to zero. And then it will wait for user interface to set down numbers like how many foods been feed per day etc. Once initialized, UI will send initialize_flag high to FSM which then the state comes to 2 (idle state).

Refill State:



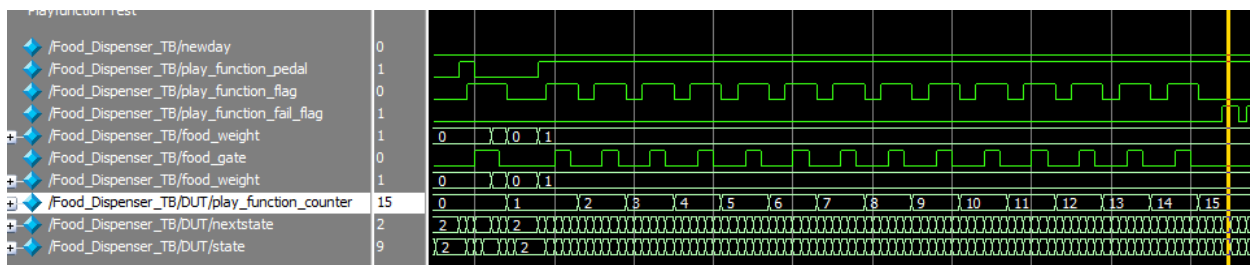
When the food in bank is not enough, refill detector will send high signal to FSM which then the FSM will come to state 7 (wait_for_refill). User will then open the cap (cap_detector = 1) and refill the bank. State will back to idle only if both refill detector back to low and cap is closed.

Play function State:



When play_function pedal is pressed, FSM will enter state 8 (play function detected). In which play_function_flag will turn to 1 and send state to state 4 (add_food). At add food state, food gate will be open, and the system start to detect the weight of the food coming out at state 5 (weight_detect). Due to it is a play function, only 1g of food will come out (By detecting play function flag). Once food weight is achieved, it lowers the play_function_flag at state 10 (play_function_complete) and back to idle state.

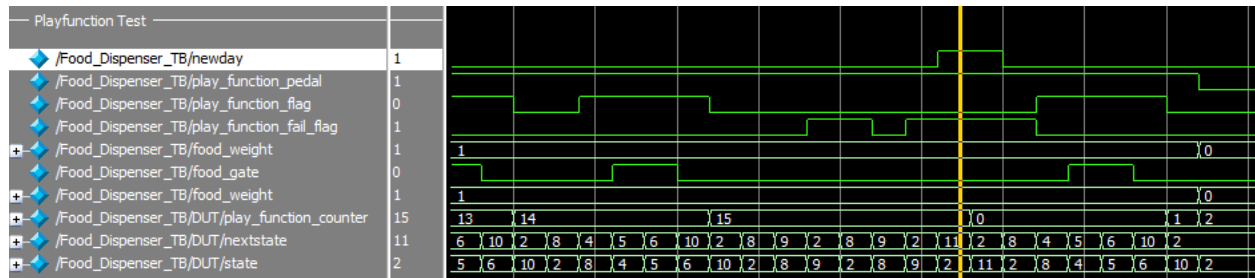
Daily limit:



However, there is 15 times limit on playfunction per day. FSM used a counter highlighted on figure above to count the times. After 15 times of play function, as can be seen on the figure above, even

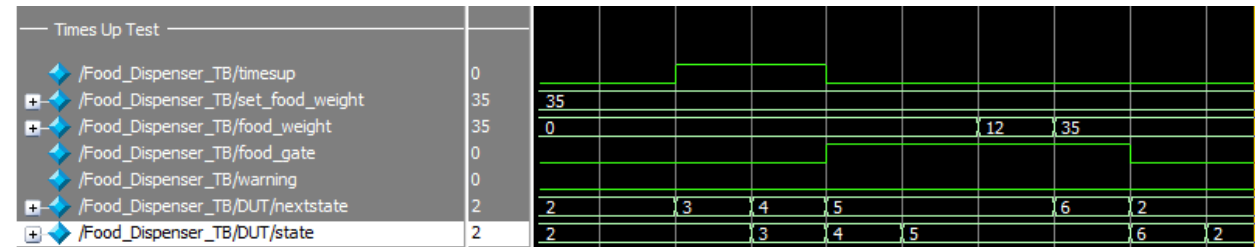
though the pedal is pressed, the food gate won't open and play_function_fail_flag will turn to high. This fail flag will be connect to LED output in another module.

New Day reset:

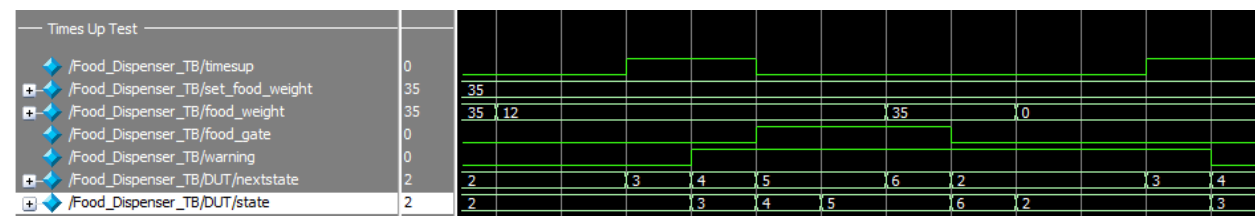


Newday is an input for the FSM. It outputs unit step to FSM when global clock detected new day. Once that's happened, counter for play function will back to zero and the function will start to work again.

Auto Feeding:

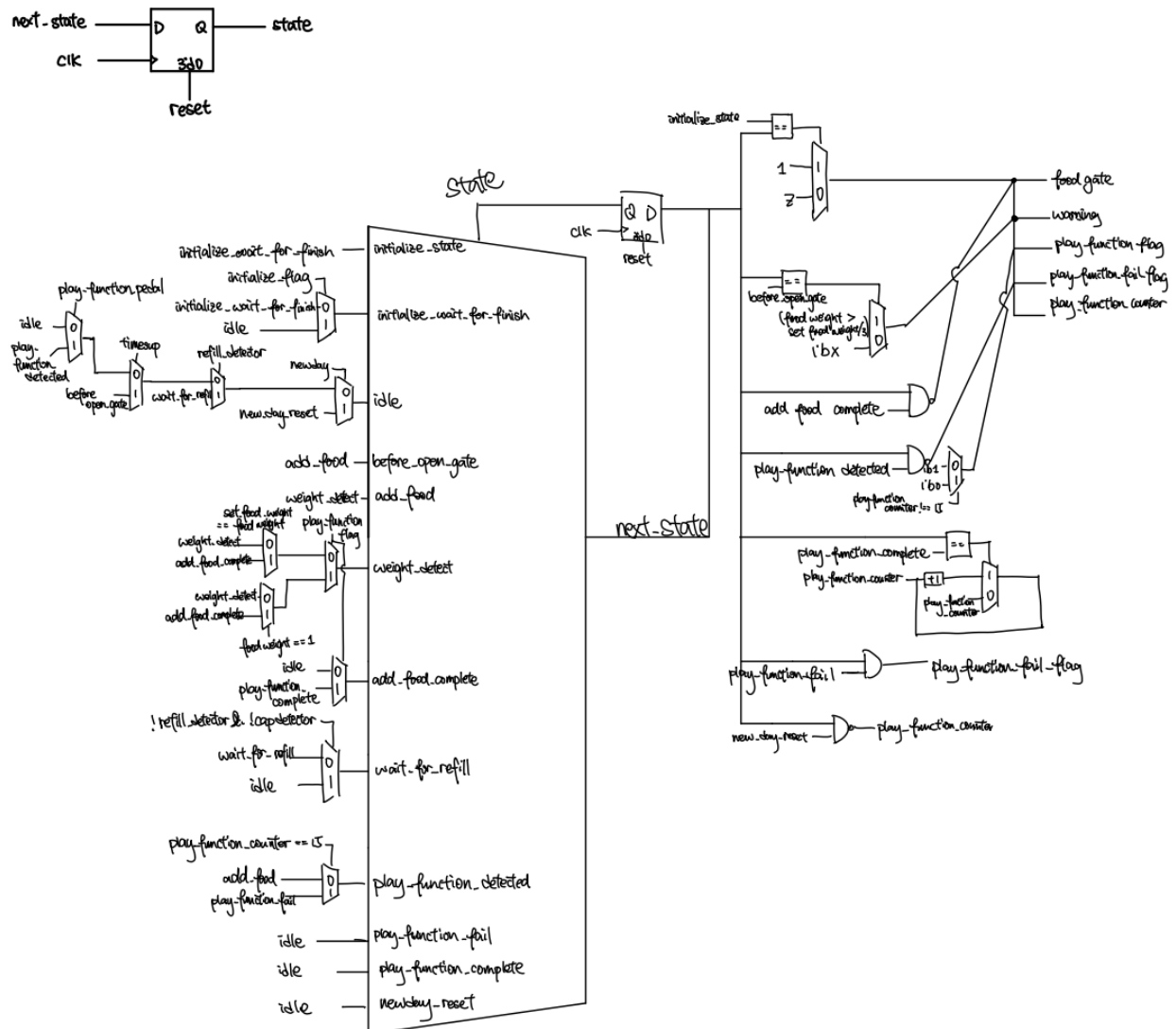


When global count down is triggered, it means the auto feed time user set has come. The FSM will read timesup signal and then run through state "add food" and "weight detect". Due to there is no play function flag this time, the function will compare the weight detected to a pre-set value (in this case 35, can be config during initialize state). Once the weight is equal, food gate will be close and state backs to idle.

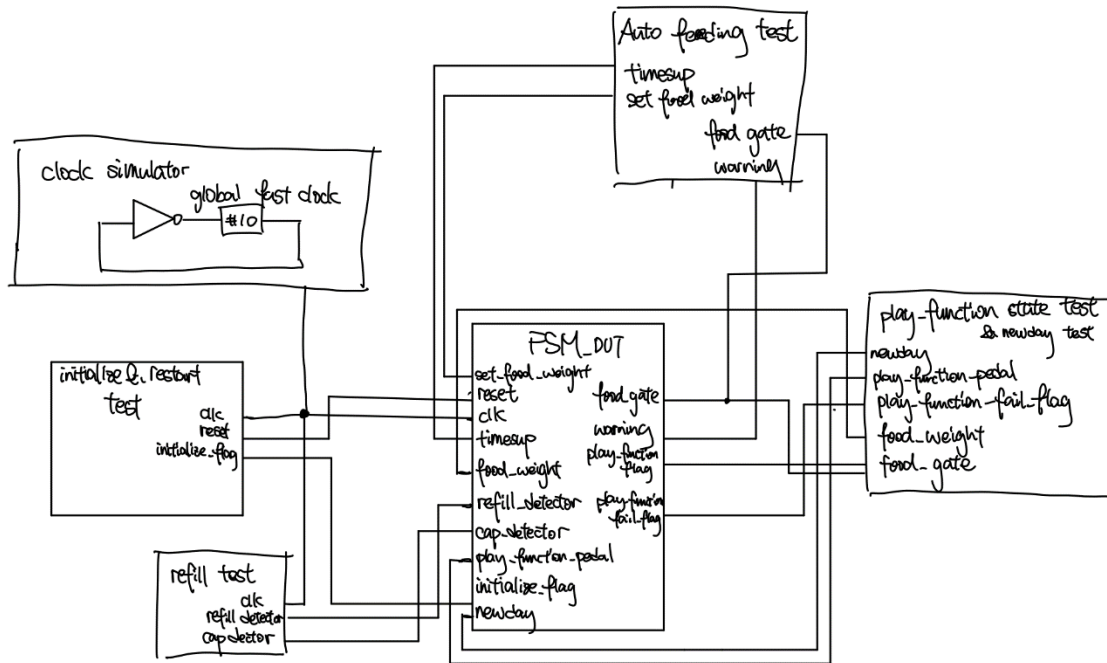


However, when pets didn't eat at least 2/3 of pre-set value of food. As can be seen on figure above, in this case the food remaining is 12g, which is larger than 1/3 of the pre-set weight (11.66g), signal warning turns to high which this signal will be connects to LED or sound output to warn user that their pet didn't finish his food. Once the food is finish, the weight back to 0, the warning signal will back to low.

Block Diagram of FSM module



Block diagram of how the module(s) and test bench are connected



State diagram of your FSM with data flow

