과제구현내용

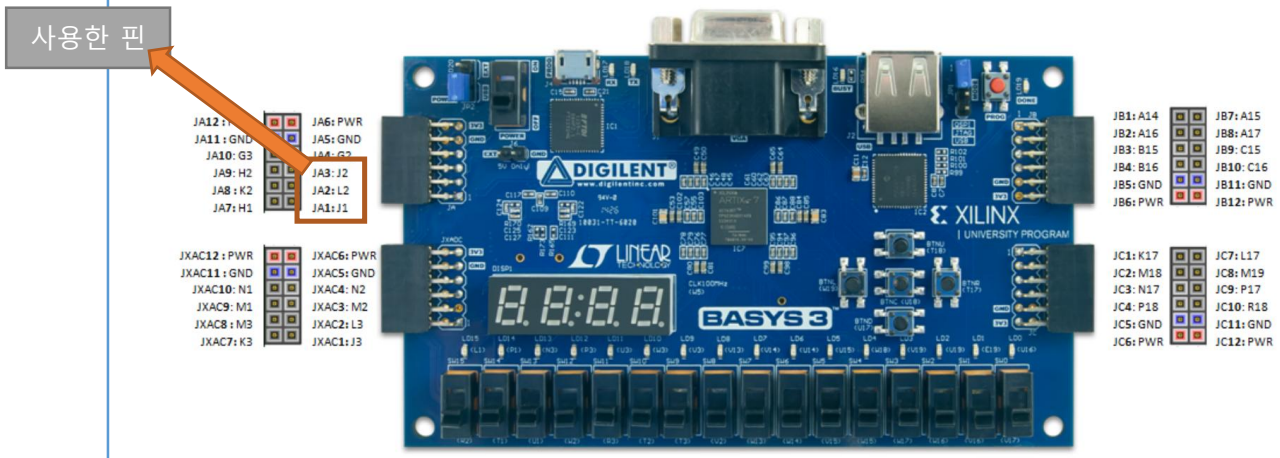
제출자:서윤철

개요

I. 소개
II. Button debounce
III. FSM
IV. 전자레인지

소개

Down CNT

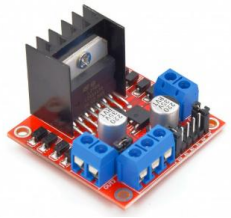


FPGA TEST

Verilog • Design

Vivado

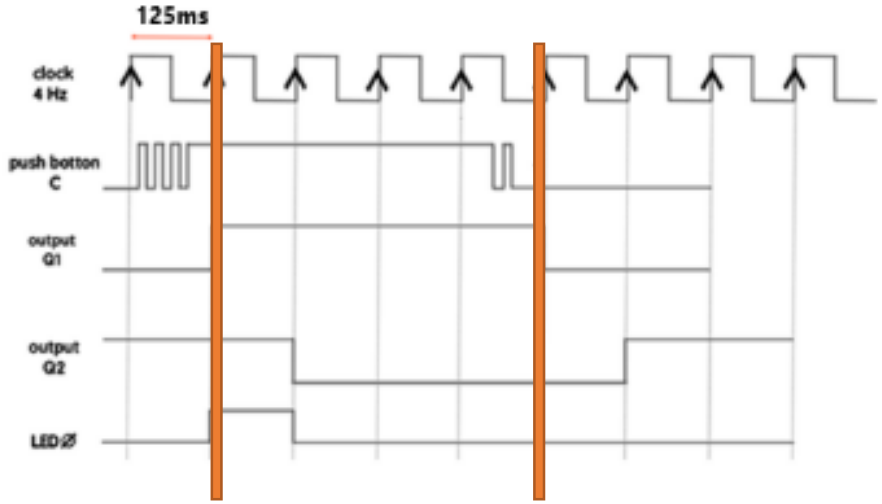
- Simulation
- Synthesis
- Bitstream



L298N Dual H-Bridge Motor Controller

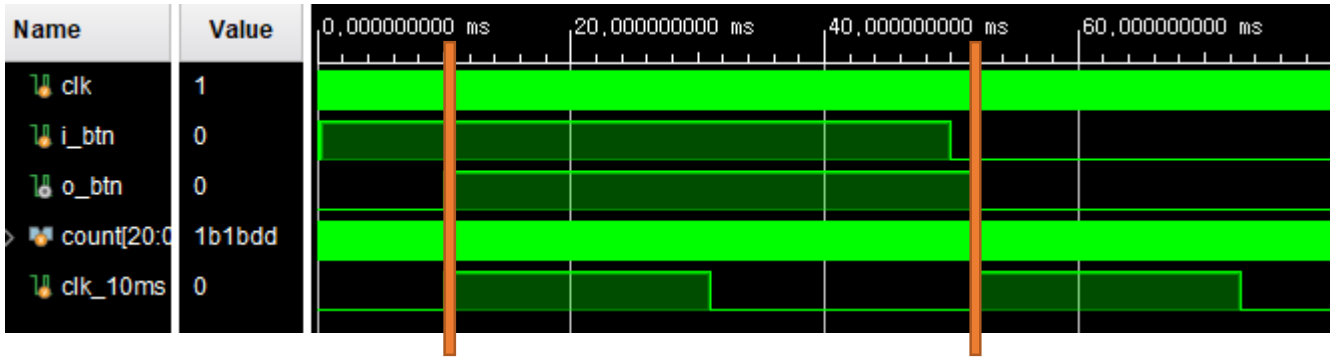
FAN

Button debounce



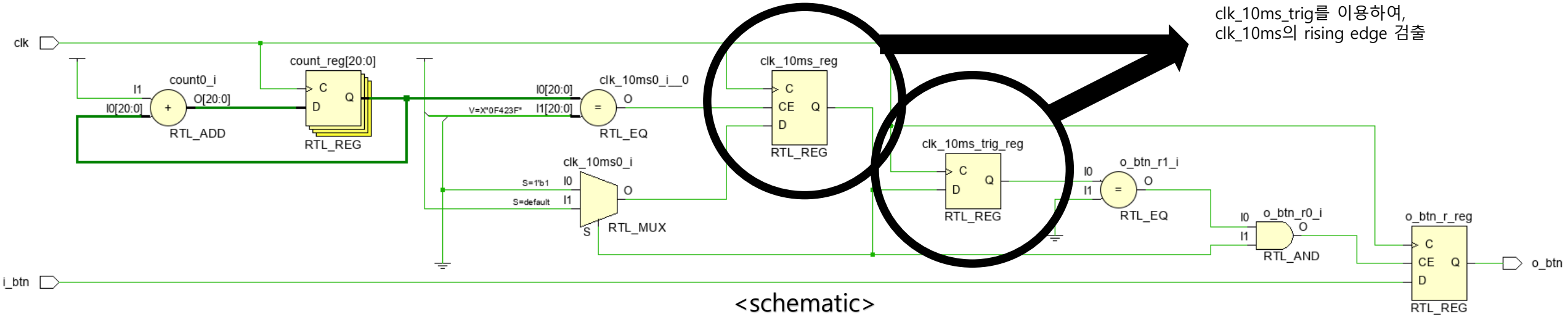
디바운싱 회로의 예상 파형

clk_10ms의 rising edge마다
o_btn 업데이트



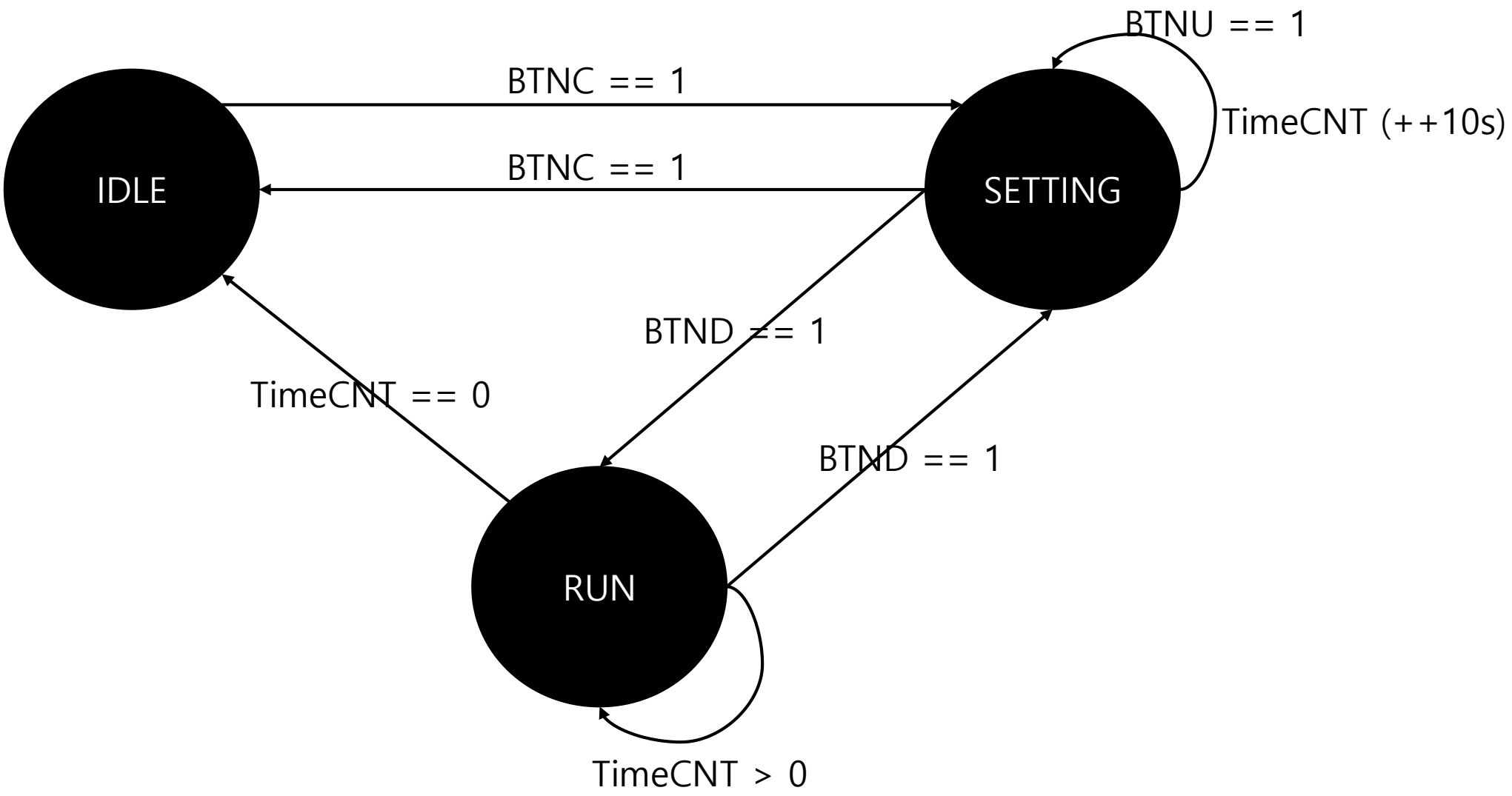
<simulation>

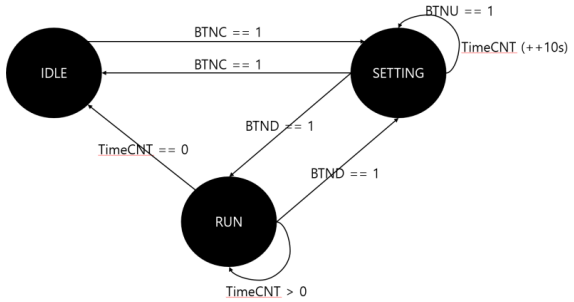
clk_10ms_trig를 이용하여,
clk_10ms의 rising edge 검출

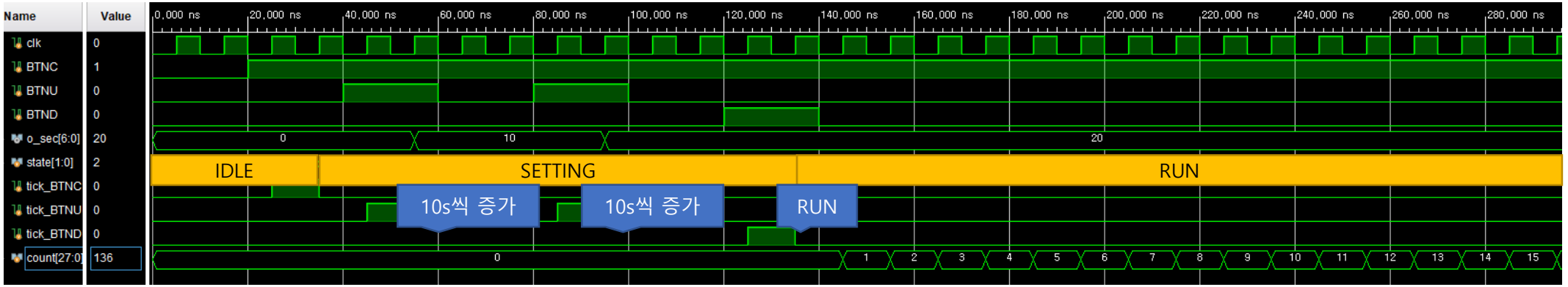


<schematic>

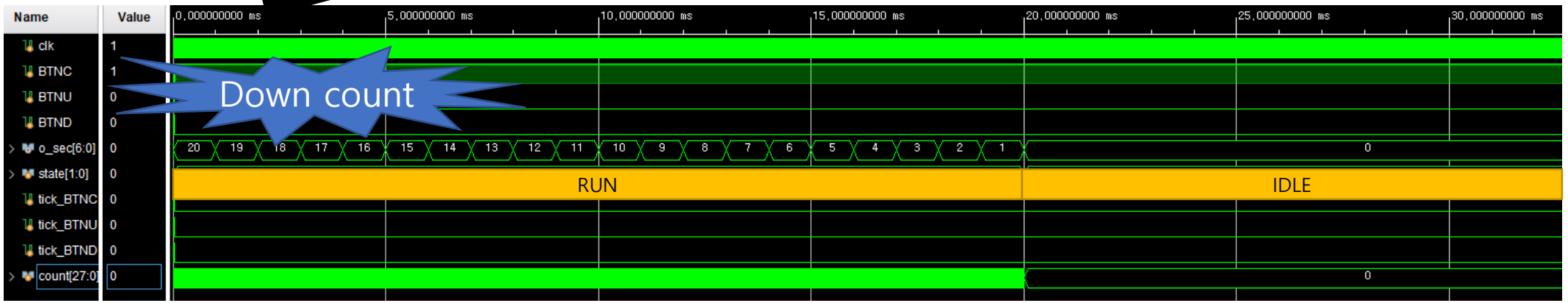
FSM


IDLE
SETTING
RUN
BTNC == 1
BTNC == 1
BTNU == 1
TimeCNT (++10s)
BTND == 1
TimeCNT == 0
BTND == 1
TimeCNT > 0





검증을 위한 count 조정



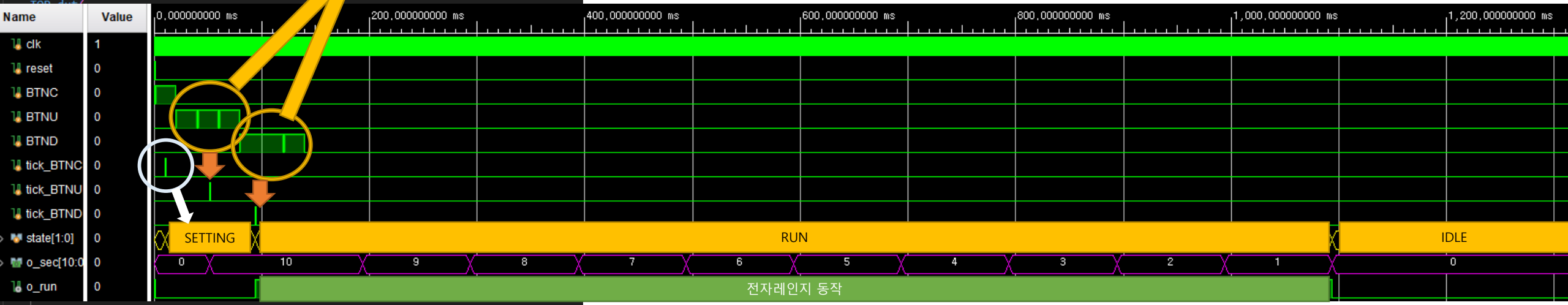
<simulation>

전자레인지

```
`timescale 1ns / 1ps

module tb_TOP();
    reg clk;
    reg [1:0] motor_direction;
    reg reset;
    reg BTNC;
    reg BTNU;
    reg BTND;
    wire o_run;
    wire [3:0] o_state;
    wire [1:0] in1_in2;
    wire [7:0] fnd_data;
    wire [3:0] fnd_com;
```

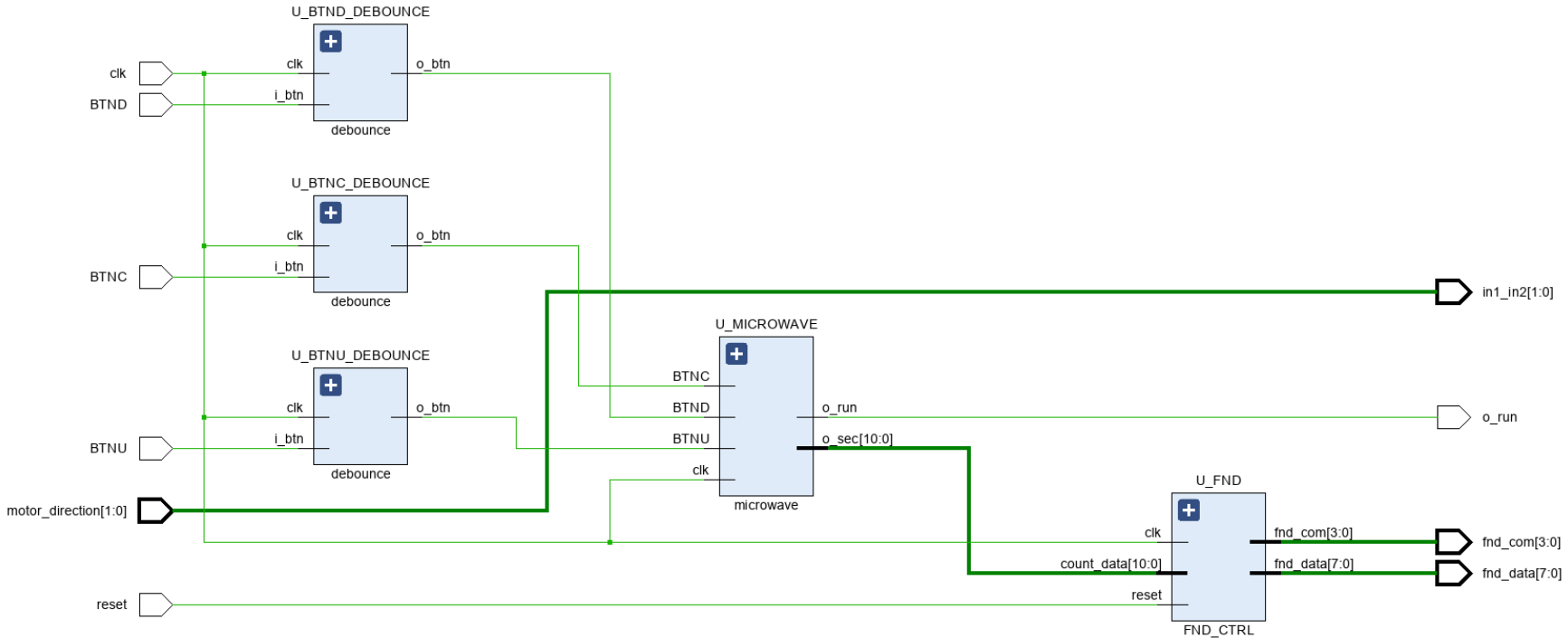
버튼 디바운스와 tick_gen을 이용하여 틱 한번 발생.



<simulation>

```
        #20; reset = 0;
        #1000; BTNC = 1;
          #20000000; BTNC = 0;
        #100; BTNU = 1;
          #20000000; BTNU = 0;
        #100; BTNU = 1;
          #20000000; BTNU = 0;
        #100; BTNU = 1;
          #20000000; BTNU = 0;
        #100; BTND = 1;//RUN
          #20000000; BTND = 0;
        #(3000000*1000); BTND = 1;
          #20000000; BTND = 0;
        #100; BTND = 1;
          #20000000; BTND = 0;
        #(2000000*1000); //IDLE
        $stop;
    end
endmodule
```

<testbench>



<schematic>

선풍기방향전환용

State 확인용(LED)

FND DATA

FND COM

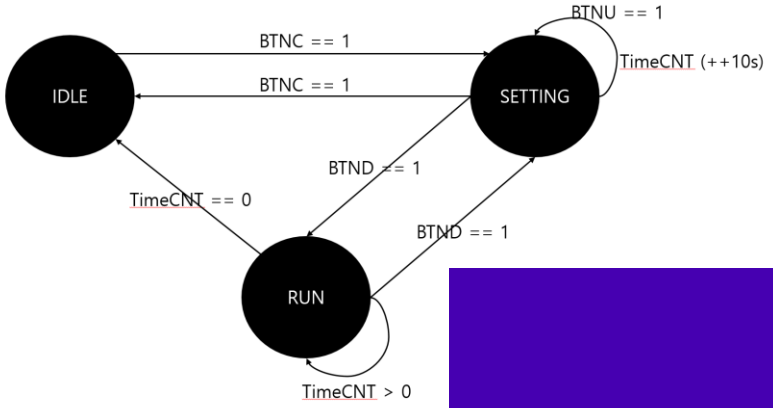
BUTTON

DC Motor PWM control

<constraint>

시연영상

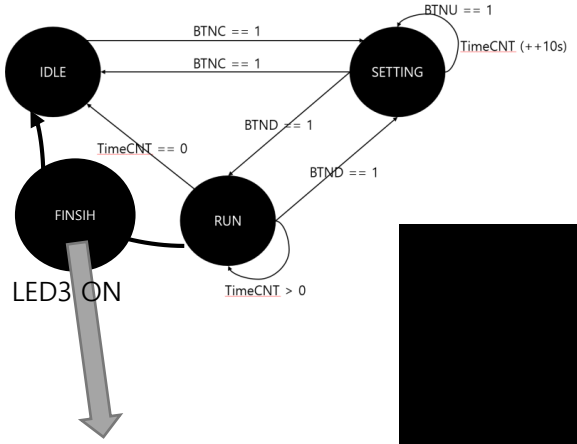
=



전자렌지 시연영상

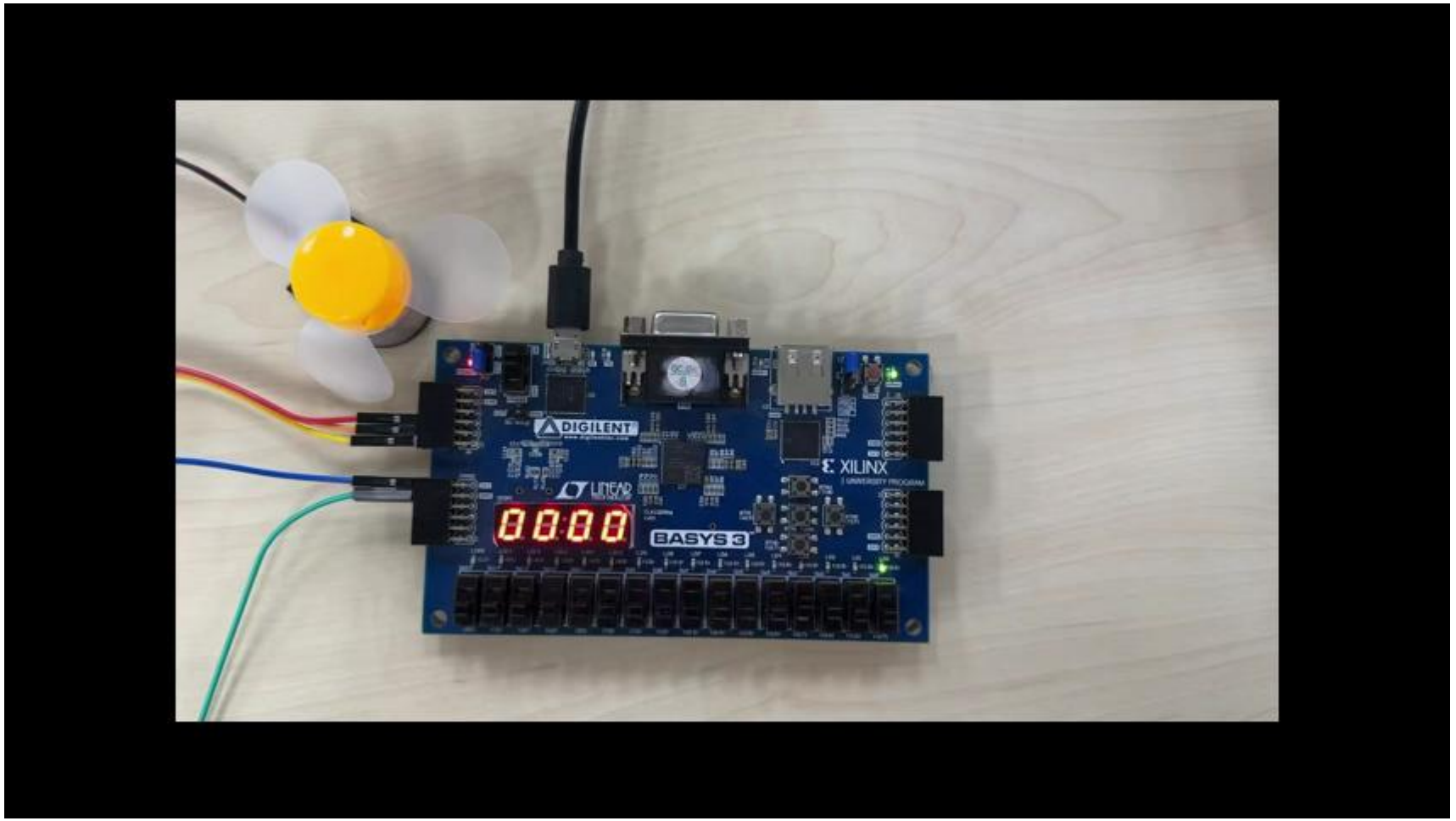
서윤철

전자레인지.V2

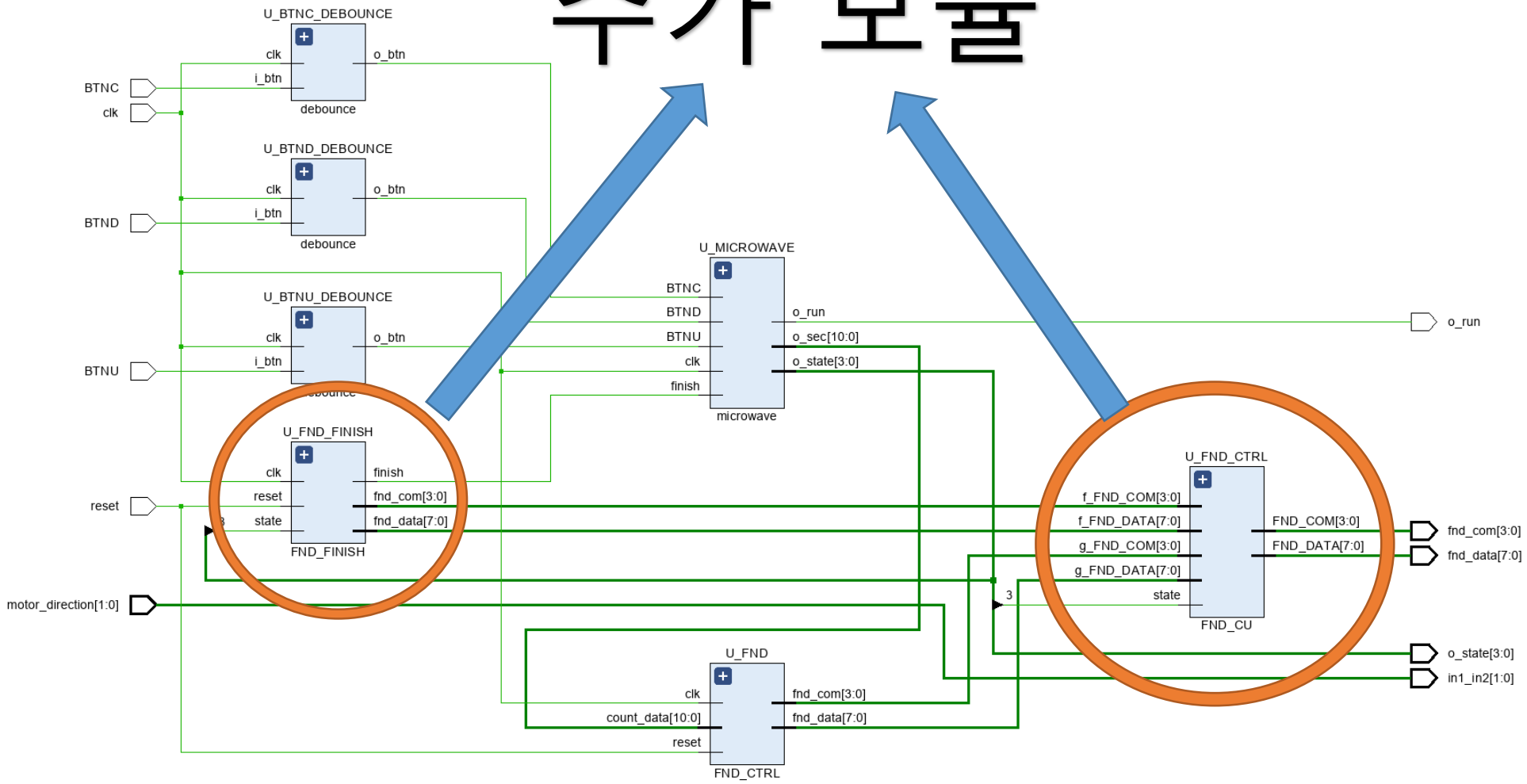


LED3 ON

+ FND 점멸
(전자레인지 종료 후 효과음 대체)



추가 모듈


U_BTNC_DEBOUNCE
clk
i_btn
o_btn
debounce
BTNC
clk
U_BTND_DEBOUNCE
clk
i_btn
o_btn
debounce
BTND
U_BTNU_DEBOUNCE
clk
i_btn
o_btn
BTNU
U_MICROWAVE
BTNC
BTND
BTNU
clk
finish
o_run
o_sec[10:0]
o_state[3:0]
microwave
o_run
U_FND_FINISH
clk
reset
state
finish
fnd_com[3:0]
fnd_data[7:0]
FND_FINISH
reset
motor_direction[1:0]
U_FND_CTRL
f_FND_COM[3:0]
f_FND_DATA[7:0]
g_FND_COM[3:0]
g_FND_DATA[7:0]
state
FND_COM[3:0]
FND_DATA[7:0]
FND_CU
fnd_com[3:0]
fnd_data[7:0]
o_state[3:0]
in1_in2[1:0]
U_FND
clk
count_data[10:0]
reset
fnd_com[3:0]
fnd_data[7:0]
FND_CTRL