Hacettepe University

Computer Engineering Department

BM233 Logic Design Lab - 2021 Fall

Verilog Final Assignment (Siganfu Machine Gun)

January 9, 2022

Student name:
Murat Beder

Student Number:
b21945891

1 Problem Definition

A Police Special Operations team codenamed "BÖRÜ" (radio code 3450) has been constantly fighting for the defense of the country from various terrorist organizations. Working at the forefront of the defense against terrorist attacks and operations, BÖRÜ Team is a dangerous, self-sacrificing and renowned group of heroes.Our mission in this assignment is design the SIGANFU machine gun control chip for help BÖRÜ Team.

2 Mealy State Transition Diagram
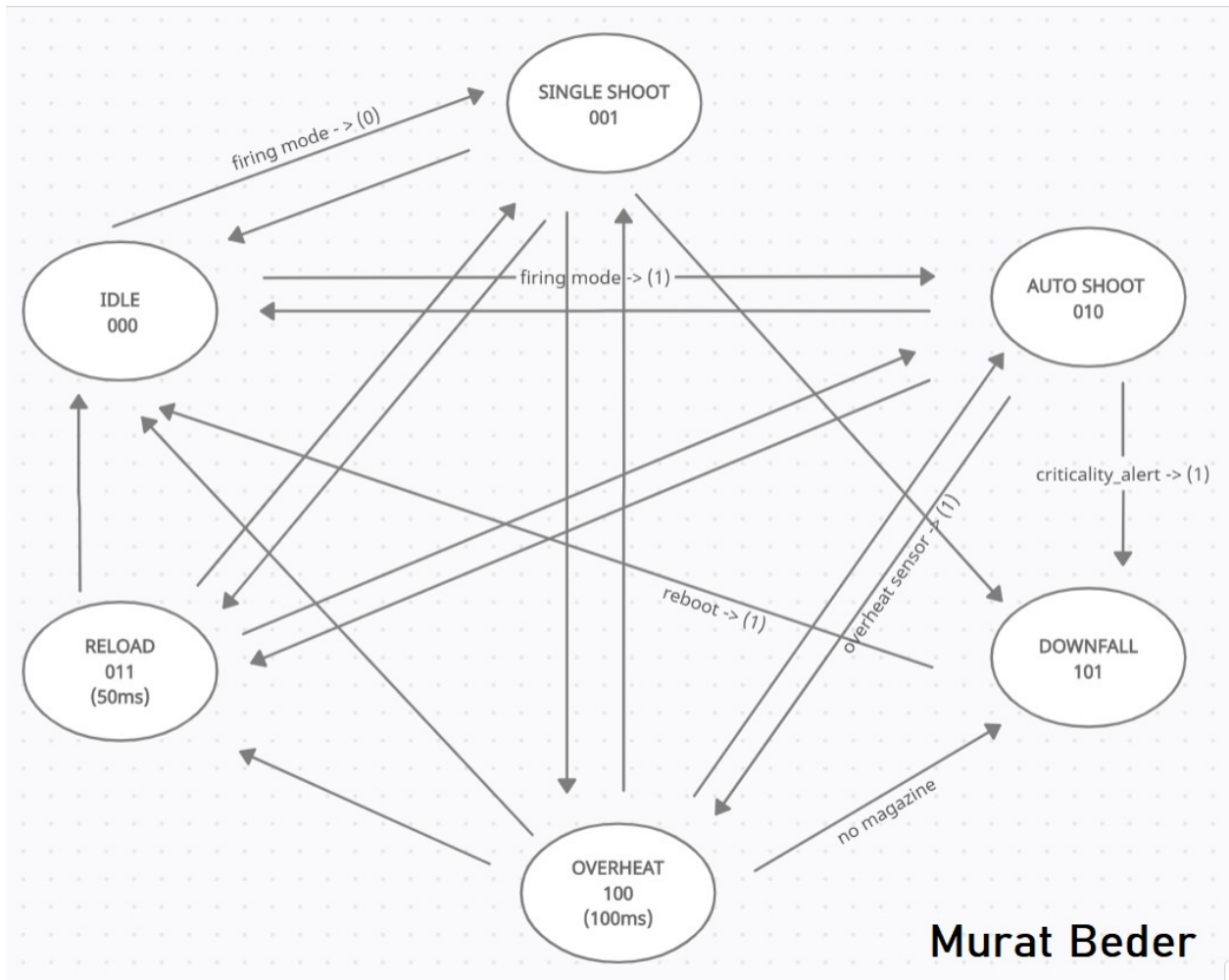
Mealy State Transition Diagram

Figure 1: Mealy State Transition Diagram

3 Solution Implementation

We have to design controller module for the SIGANFU MACHINE GUN using Verilog.

```verilog
1  `timescale 1ms / 100ns
2
3  module siganfu_machine_gun (
4          input sysclk ,
5          input reboot ,
6          input target_locked ,
7          input is_enemy ,
8          input fire_command ,
9          input firing_mode ,
```

```verilog
10          input overheat_sensor,
11          output reg[2:0] current_state,
12          output reg criticality_alert,
13          output reg fire_trigger
14  );
15
16      integer bullet_counter = 25;
17      integer  magazine_counter = 3;
18      reg control_single;
19
20
21          always @(posedge sysclk or posedge reboot) begin
22
23              if (reboot) begin
24
25                  // If reboot occurs (current_state, criticality_alert, fire_trigger) i
26                  assign current_state = 3'b000;
27                  assign criticality_alert = 0;
28                  assign fire_trigger = 0;
29
30                  control_single = 0;
31              end
32
33              else begin
34
35                  if(target_locked && is_enemy && fire_command) begin
36
37                      // If all the required inputs reach the desired values, the shot m
38                      if (overheat_sensor) begin
39                          // When the machine gun overheats from shooting, it has to be
    process takes 100 ms.
40                          assign current_state = 3'b100;
41                          assign fire_trigger = 0;
42                          #100;
43                          assign current_state = 3'b000;
44                      end
45
46                      else begin
47                          // if the program is not switched to overheat mode
48                          // checks the number of bullets. if there are no bullets left
49                          if (bullet_counter > 0) begin
50
51                              if (firing_mode) begin
52                                  // While in this state, the machine gun is in the aut
53                                  assign fire_trigger = 1;
54                                  assign current_state = 3'b010;
55                                  bullet_counter = bullet_counter - 1;
56                                  #5;
```

```verilog
57                         assign fire_trigger = 0;
58                 end
59
60                 else begin
61                 if (!control_single) begin
62                     assign fire_trigger = 1;
63                     assign current_state = 3'b001;
64                     bullet_counter = bullet_counter - 1;
65                     #5;
66                     assign fire_trigger = 0;
67                     #5;
68                     control_single = 1;
69                 end
70
71                 end
72
73             end
74
75         else begin
76              // If there is no lead left in the magazine we have
77             assign fire_trigger = 0;
78             control_single = 0;
79
80             if (magazine_counter > 1)begin
81                  // If we still have a spare magazines , it enters this
82                 bullet_counter = 25;
83                 magazine_counter = magazine_counter - 1;
84                 assign current_state = 3'b011;
85                 #50;
86             end
87
88             else if (magazine_counter == 1) begin
89                  // If we have the last spare clip left , we'll take it
90                  // So the criticality_alert will be high and the relo
91                 bullet_counter = 25;
92                 magazine_counter = magazine_counter- 1;
93                 assign current_state = 3'b011;
94                 #50;
95                 assign criticality_alert = 1;
96             end
97
98             else begin
99                  // When all of the magazines and ammo have been exhau
100                assign current_state = 3'b101;
101            end
102
103        end
104    end
```

```
105                     end
106
107                 else if (control_single && !fire_command) begin
108                     // In this state, the machine gun is at rest. No shots are be
109                     assign current_state = 3'b000;
110                     control_single = 0;
111                 end
112
113             end
114
115         end
116
117 endmodule
```
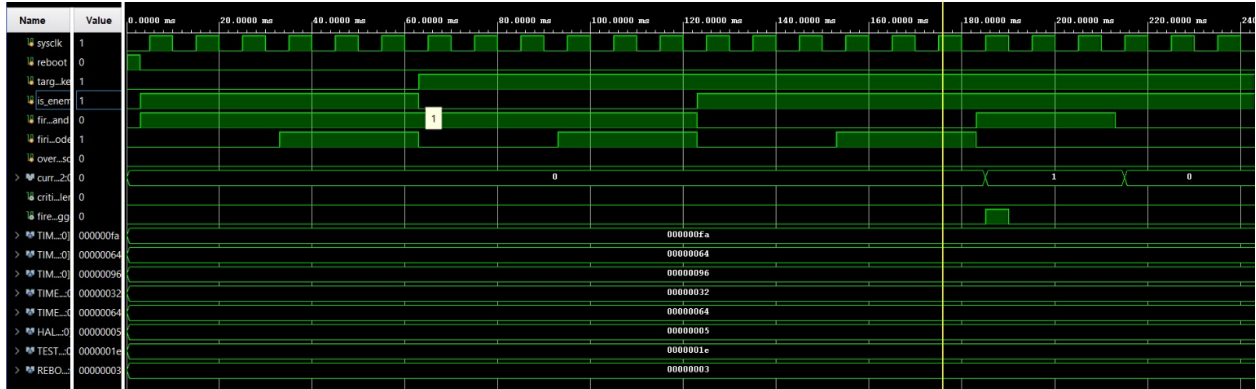
4 Results

4.1 TEST 1: Safety Test

Safety Test Waveform

Figure 2: Safety Test Waveform

4.2 TEST 2: Single Shooting Test

Single Shooting Test Waveform

4.3 TEST 3: Automatic Shooting Test

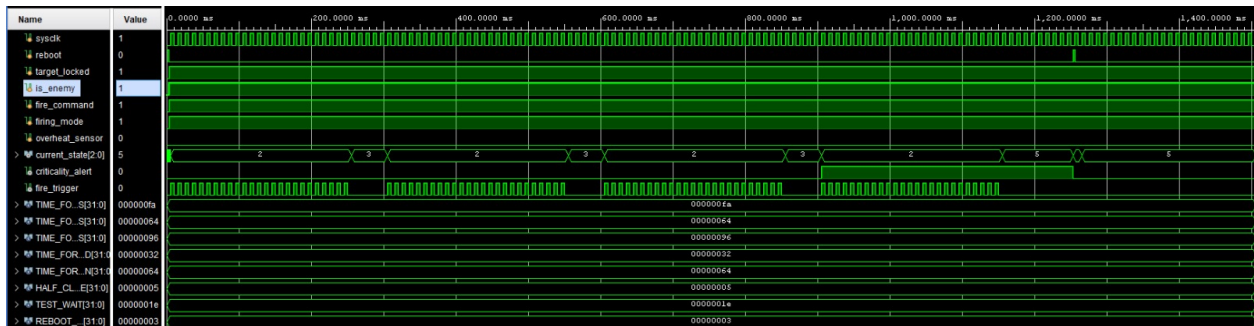Automatic Shooting Test Waveform
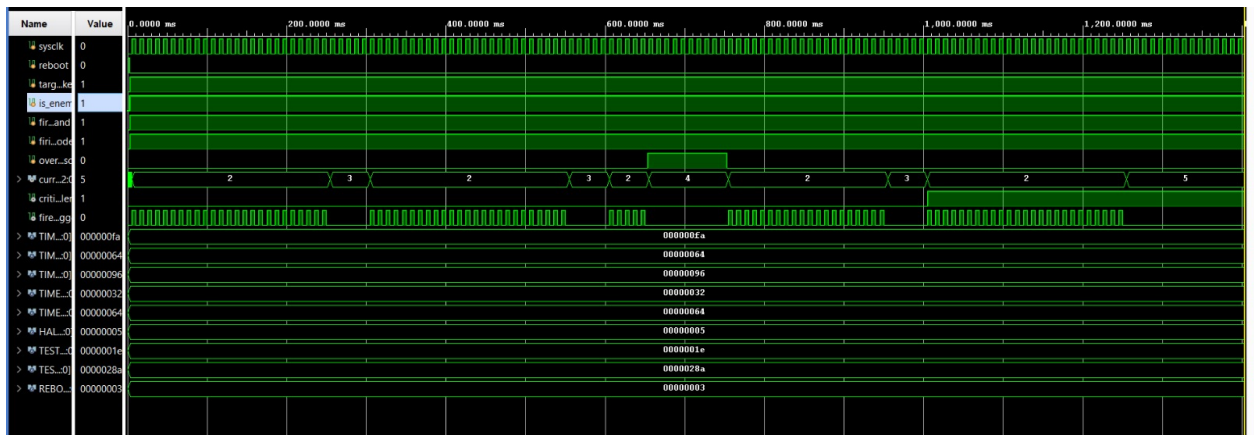
Figure 3: Single Shooting Test Waveform

Figure 4: Automatic Shooting Test Waveform

Figure 5: Returning from RELOAD and OVERHEAT Test Waveform

4.4 TEST 4: Returning from RELOAD and OVERHEAT Test

Returning from RELOAD and OVERHEAT Test Waveform

4.5 TEST 5: RELOAD after OVERHEAT Test
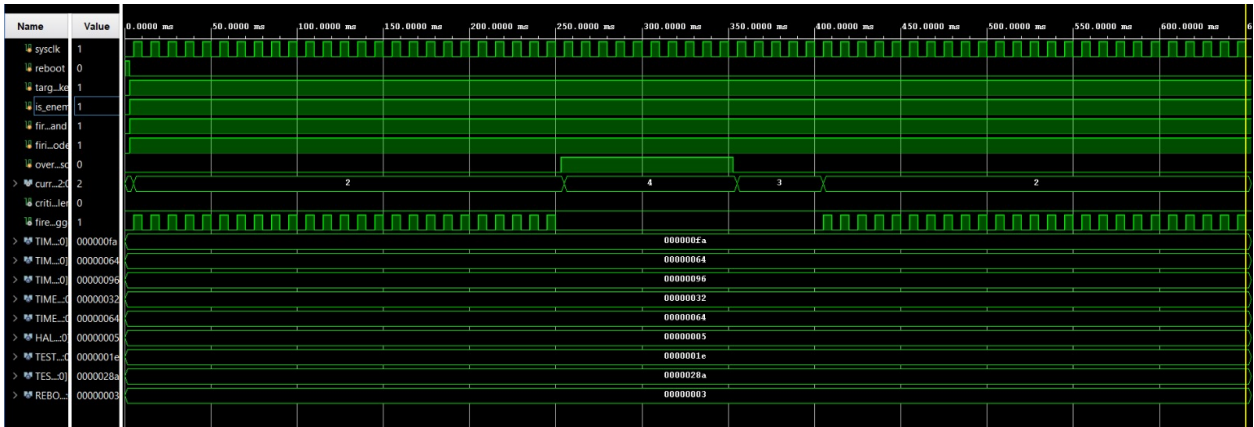
RELOAD after OVERHEAT Test Waveform

Figure 6: RELOAD after OVERHEAT Test Waveform
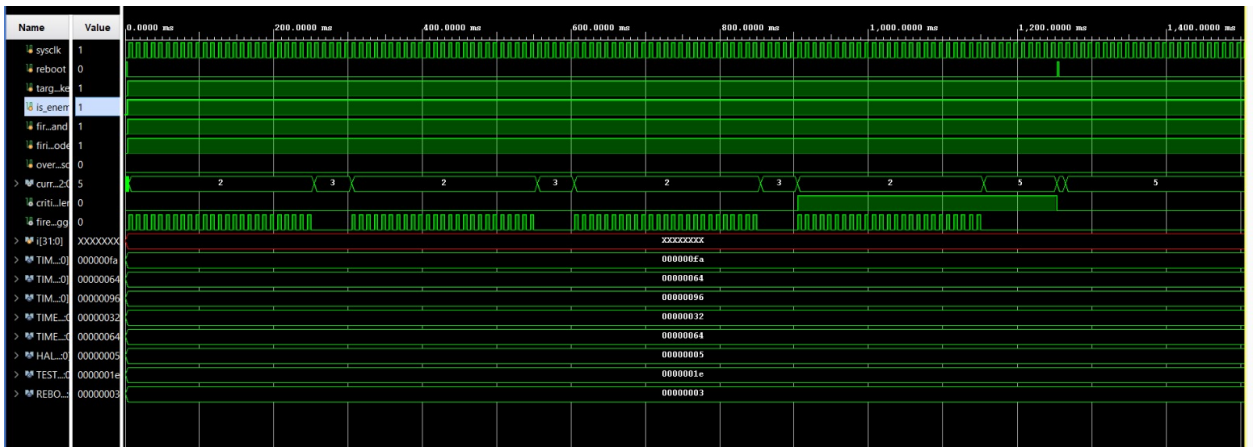
4.6 TEST 6: REBOOT Test

REBOOT Test Waveform

Figure 7: REBOOT Test Waveform

References

- https://www.blutv.com/diziler/yerli/boru-2039

- https://youtu.be/qSLRujmsfz0

- https://brilliant.org/wiki/finite-state-machines/