Vending Machine

TEAM VENDTECH

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Contents

- Implementation on FPGA
- Code
- FSM Diagram
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Hardware

- Nexys Artix 7 100t FPGA

VHDL Code


```
5  entity vendingmachine is
6      Port(
7        clk_in  : in std_logic;
8        reset   : in std_logic;
9        AN_IN   : out std_logic_vector(7 downto 0);
10       LED_OUT : out std_logic_vector(6 downto 0);
11       SW2     : in std_logic_vector(2 downto 0);
12       SW3     : in std_logic_vector(1 downto 0);
13       SW4     : in std_logic;
14       LED_G, LED_R : out std_logic;
15       SW      : in std_logic_vector(2 downto 0)
16     );
17 end vendingmachine;
18
```

```
19  architecture Behavioral of vendingmachine is
20      signal counter : integer range 0 to 100000 := 0;
21      signal clk_out : std_logic := '0';
22      constant DIVIDER_VALUE : integer := 100000;
23      signal temp : integer range 0 to 9 := 0;
24
25      type StateType is (Idle, item_select, Coin, Dispense);
26      signal next_state : StateType := Idle;
27
28  begin
29      -- Clock divider process
30      process (clk_in, reset)
31      begin
32          if reset = '1' then
33              counter <= 0;
34              clk_out <= '0';
35          elsif rising_edge(clk_in) then
36              if counter = DIVIDER_VALUE then
37                  counter <= 0;
38                  clk_out <= not clk_out;
39                  if temp = 9 then
40                      temp <= 0;
41                  else
42                      temp <= temp + 1;
43                  end if;
44              else
45                  counter <= counter + 1;
46              end if;
47          end if;
48      end process;
```

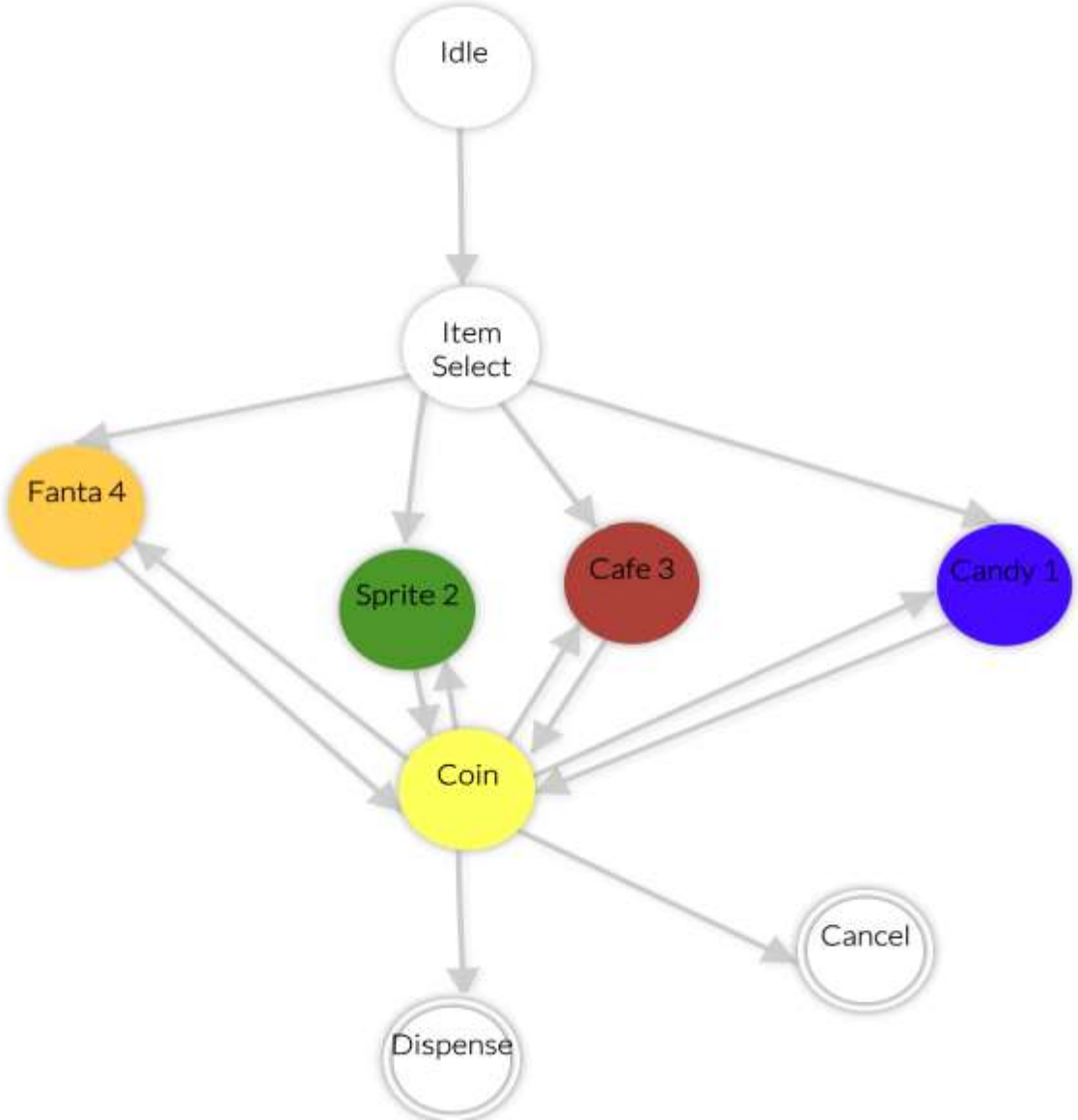
```
49
50    -- State transition process
51    process (SW)
52    begin
53      if SW = "001" then
54        next_state <= Idle;
55      elsif SW = "010" then
56        next_state <= item_select;
57      elsif SW = "100" then
58        next_state <= Coin;
59      elsif SW = "111" then
60        next_state <= Dispense;
61      else
62        next_state <= Idle;
63      end if;
64    end process;
65
```

```
66    -- Item selection display process
67    process (SW2, temp)
68    begin
69      if next_state = item_select then
70        if SW2 = "000" then
71          -- Display Fanta
72       if temp = 0 then
73        AN_IN <= "01111111";
74        LED_OUT <= "0001110"; -- F
75  elsif temp = 1 then
76        AN_IN <= "10111111";
77        LED_OUT <= "0001000"; -- A
78  elsif temp = 2 then
79        AN_IN <= "11011111";
80        LED_OUT <= "0101011"; -- n
81  elsif temp = 3 then
82        AN_IN <= "11101111";
83        LED_OUT <= "0000111"; -- T
84        elsif temp = 4 then
85        AN_IN <= "11110111";
86        LED_OUT <= "0001000"; -- A
87  elsif temp = 5 then
88        AN_IN <= "11111110";
89        LED_OUT <= "0011001"; -- 4
90  else
91        AN_IN <= "11111111";
92        LED_OUT <= "1111111"; -- all segments off
93  end if;
```

```
elsif next_state = Dispense then
  if SW4 = '1' then
    if SW2 = "000" then --Fanta 2
      if SW3 = "01" then --2
        AN_IN <= "11111101";
        LED_OUT <= "0100100"; --2 (red)
         elsif SW3 = "00" then --1
        AN_IN <= "11111101";
        LED_OUT <= "0110000"; --3 (red)
      elsif SW3 = "10" then --3
        AN_IN <= "11111101";
        LED_OUT <= "1001111"; --1 (red)
      elsif SW3 = "11" then --4
        AN_IN <= "11111101";
        LED_OUT <= "1000000"; -- 0 (green)
      else
        AN_IN <= "11111111";
        LED_OUT <= "1111111";
      end if;
```

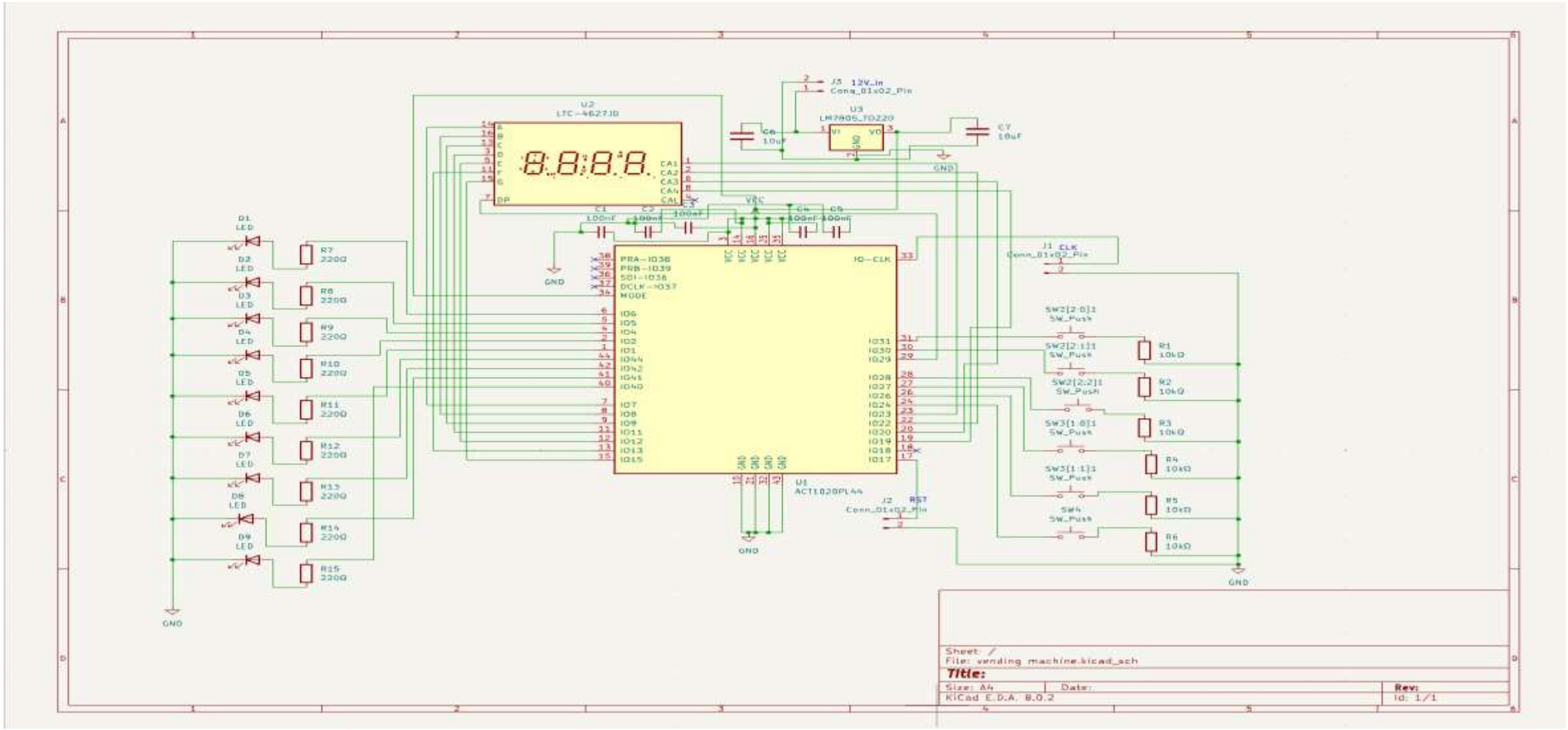
```
begin
  if next_state = Dispense then
    if SW4 = '1' then
      if SW2 = "000" then
        if SW3 = "00" then
          LED_G <= '0';
          LED_R <= '1';
        elsif SW3 = "01" then
          LED_G <= '0';
          LED_R <= '1';
        elsif SW3 = "10" then
          LED_G <= '0';
          LED_R <= '1';
        elsif SW3 = "11" then
          LED_G <= '1';
          LED_R <= '0';
        else
          LED_G <= '1';
          LED_R <= '1';
        end if;
```

Finite State Model Diagram

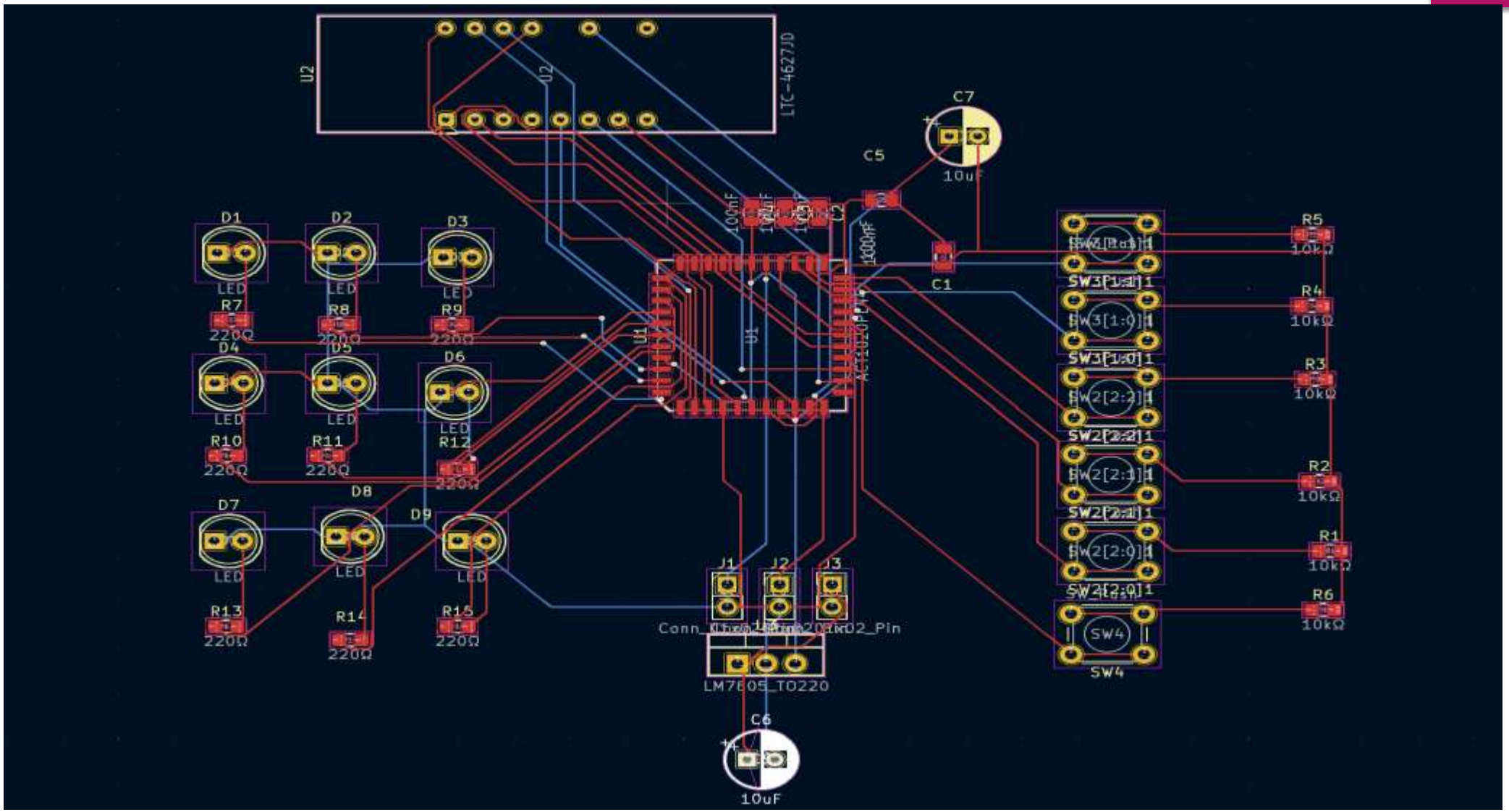


PCB Design

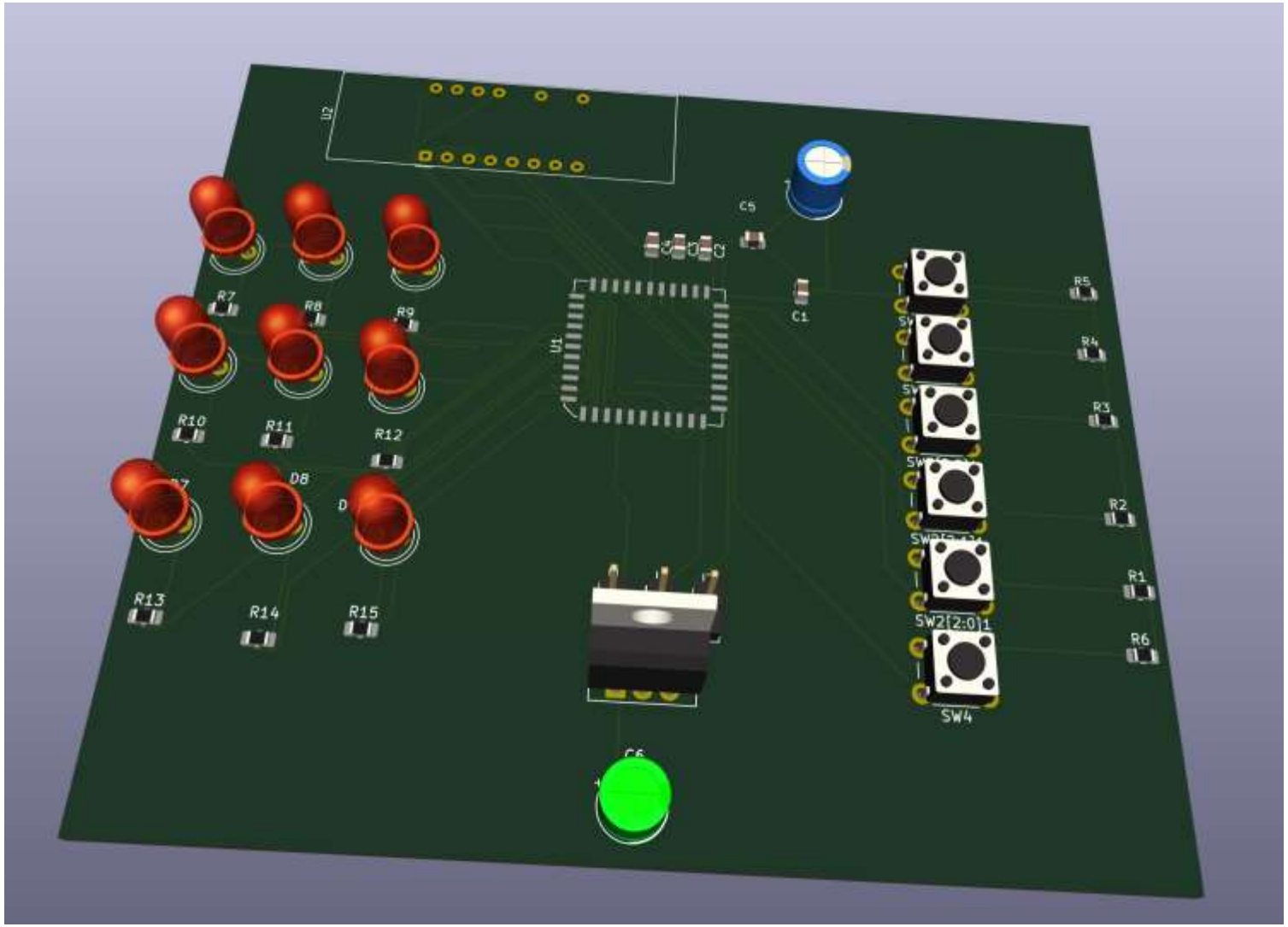
Schematic Design



PCB Board


U2
LTC-4627JD
C7
10uF
C5
C1
D1
D2
D3
D4
D5
D6
D7
D8
D9
LED
R7
R8
R9
R10
R11
R12
R13
R14
R15
220Ω
R5
R4
R3
R2
R1
R6
10kΩ
SW4
J1
J2
J3
LM7805_TO220
C6
10uF

3D View of PCB Board



THANK YOU