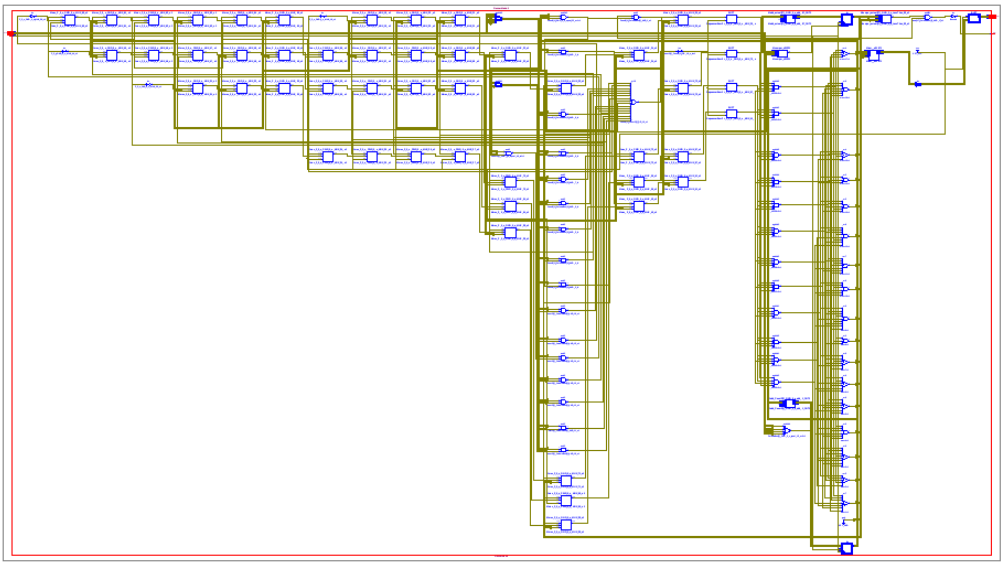

```
------------ Code ------------
------ Orlando Reyes ------
--------- Auf Das ---------
---------- Guzzer ----------
-------- 10/09/2024 --------
------- Main Library -------
library IEEE;
use IEEE.STD_LOGIC_1164.all;
use IEEE.STD_LOGIC_ARITH.ALL;
use IEEE.STD_LOGIC_UNSIGNED.ALL;

entity GuzzerMatrix is
    port
    (
    CLK : in std_logic;
    Buzzer : out std_logic ;
    --- Sequencer ---
    rowSelect: out std_logic_vector(3 downto 0);

    --- Matrix Keyboard ---
    ColumnBus : in std_logic_vector(3 downto 0)

    );
end GuzzerMatrix;

architecture juve3dstudio of GuzzerMatrix is
    signal Count2 : STD_LOGIC_VECTOR(1 downto 0) := "00";
    signal siguiente, actual : STD_LOGIC_VECTOR(17 downto 0) :=
"000000000000000000";
    signal mux : STD_LOGIC_VECTOR(16 downto 0) := "00000000000000000";
```

```
    signal SequencerBus      : std_logic_vector(3 downto 0) := "0000";
    ----- Musical Variables -----
    -- half
        signal DoMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10111010101000100"; -- 191110
        signal DoSosMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10110000001010011"; -- 180389
        signal ReMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10100110010001101"; -- 170265
        signal ReSosMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10011100111100001"; -- 160705
        signal MiMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10010100001000100"; -- 151686
        signal FaMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10001011110100011"; -- 143173
        signal FaSosMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"10000011111110010"; -- 135139
        signal SolMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"01111100100100001"; -- 127552
        signal SolSosMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"01110101100100110"; -- 120395
        signal LaMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"01101110111110011"; -- 113637
        signal LaSosMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"01101000101111111"; -- 107260
        signal SiMicha :STD_LOGIC_VECTOR(16 downto 0) :=
"01100010110111101"; -- 101240

begin
    Count2 <= Count2 + '1' when CLK'event and CLK = '1' and ColumnBus =
"0000";

    with Count2 select
    rowSelect<= "1ZZZ" when "00",
                "Z1ZZ" when "01",
                "ZZ1Z" when "10",
                "ZZZ1" when "11",
                "ZZZZ" when others;


    SequencerBus <= "0000" when Count2 = "00" and ColumnBus = "0000"
else  -- 0
            "0001" when Count2 = "00" and ColumnBus = "0001" else  -- 1
            "0010" when Count2 = "00" and ColumnBus = "0010" else  -- 2
            "0011" when Count2 = "00" and ColumnBus = "0100" else  -- 3
            "0100" when Count2 = "00" and ColumnBus = "1000" else  -- 4

            "0101" when Count2 = "01" and ColumnBus = "0001" else  -- 5
            "0110" when Count2 = "01" and ColumnBus = "0010" else  -- 6
```

```
            "0111" when Count2 = "01" and ColumnBus = "0100" else  -- 7
            "1000" when Count2 = "01" and ColumnBus = "1000" else  -- 8

            "1001" when Count2 = "10" and ColumnBus = "0001" else  -- 9
            "1010" when Count2 = "10" and ColumnBus = "0010" else  -- 10
            "1011" when Count2 = "10" and ColumnBus = "0100" else  -- 11
            "1100" when Count2 = "10" and ColumnBus = "1000" else  -- 12

            "1101" when Count2 = "11" and ColumnBus = "0001" else  -- 13
            "1110" when Count2 = "11" and ColumnBus = "0010" else  -- 14
            "1111" when Count2 = "11" and ColumnBus = "0100" else  -- 15
            "ZZZZ";


    mux <= DoMicha      when SequencerBus = "0000"  else  -- 0
           DoSosMicha   when SequencerBus = "0001"  else  -- 1
           ReMicha      when SequencerBus = "0010"  else  -- 2
           ReSosMicha   when SequencerBus = "0011"  else  -- 3
           MiMicha      when SequencerBus = "0100"  else  -- 4

           FaMicha      when SequencerBus = "0101"  else  -- 5
           FaSosMicha   when SequencerBus = "0110"  else  -- 6
           SolMicha     when SequencerBus = "0111"  else  -- 7
           SolSosMicha when SequencerBus = "1000"  else  -- 8

           LaMicha      when SequencerBus = "1001"  else  -- 9
           LaSosMicha   when SequencerBus = "1010"  else  -- 10
           SiMicha      when SequencerBus = "1011"  else  -- 11
           "0000000000000000";


    -- Memoria --
    actual <= siguiente when CLK'event and CLK = '1';
    -- Logica de estado Siguiente --
    siguiente <= actual + '1' when actual < mux & '0' else
"00000000000000000";
    -- Logica de Salida --
    Buzzer <= '0' when actual < mux  and not(ColumnBus = "0000") else
'1';

end juve3dstudio;
```

```
-------- Testbench --------
------ Orlando Reyes ------
--------- Auf Das ---------
----------- Tmat -----------
```

```
-------- 27/08/2024 --------
library IEEE;
use IEEE.STD_LOGIC_1164.all;

entity tb is
end tb;

architecture sim of tb is

    component GuzzerMatrix
    port
    (
        CLK : in std_logic;
        Buzzer : out std_logic;
        --- Sequencer ---
        rowSelect: out std_logic_vector(3 downto 0);
        --- Matrix Keyboard ---
        ColumnBus : in std_logic_vector(3 downto 0)
    );
    end component;

    signal S_CLK, S_Buzzer: std_logic;
    signal S_rowSelect: std_logic_vector(3 downto 0);
    signal S_ColumnBus: std_logic_vector(3 downto 0);

begin

    uut: GuzzerMatrix port map (S_CLK, S_Buzzer, S_rowSelect,
S_ColumnBus);

    process
    begin
        wait for 100 ns;
        S_CLK <= '0';
        wait for 100 ns;
        S_CLK <= '1';

    end process;

    process
    begin
        wait for 300 ns;
        S_ColumnBus <= "0001";
        wait for 900 ns;
        -- 1st Column ---
        S_ColumnBus <= "0010";
        wait for 800 ns;
        S_ColumnBus <= "0100";
        wait for 800 ns;
```

```
        S_ColumnBus <= "1000";
        wait for 800 ns;
        S_ColumnBus <= "0000";
        wait for 100 ns;

        -- 2nd Column ---
        S_ColumnBus <= "0001";
        wait for 900 ns;
        S_ColumnBus <= "0010";
        wait for 800 ns;
        S_ColumnBus <= "0100";
        wait for 800 ns;
        S_ColumnBus <= "1000";
        wait for 800 ns;
        S_ColumnBus <= "0000";
        wait for 100 ns;

        -- 3rd Column ---
        S_ColumnBus <= "0001";
        wait for 900 ns;
        S_ColumnBus <= "0010";
        wait for 800 ns;
        S_ColumnBus <= "0100";
        wait for 800 ns;
        S_ColumnBus <= "1000";
        wait for 800 ns;
        S_ColumnBus <= "0000";
        wait for 100 ns;

        -- 4th Column ---
        S_ColumnBus <= "0001";
        wait for 900 ns;
        S_ColumnBus <= "0010";
        wait for 800 ns;
        S_ColumnBus <= "0100";
        wait for 800 ns;
        S_ColumnBus <= "1000";
        wait for 800 ns;
        S_ColumnBus <= "0000";
        wait for 100 ns;

        wait;
    end process;

end sim;
```

```
NET "CLK" LOC = P126;


NET "Buzzer" LOC=P44  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW = FAST ;

NET "ColumnBus[0]" LOC=P7  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST ;
NET "ColumnBus[1]" LOC=P5  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST ;
NET "ColumnBus[2]" LOC=P1  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST ;
NET "ColumnBus[3]" LOC=P141  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST ;
NET "rowSelect[0]" LOC=P139  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST | PULLDOWN  ;
NET "rowSelect[1]" LOC=P137  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST | PULLDOWN  ;
NET "rowSelect[2]" LOC=P133  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST | PULLDOWN  ;
NET "rowSelect[3]" LOC=P131  | IOSTANDARD = LVCMOS33 | DRIVE = 8 | SLEW =
FAST | PULLDOWN  ;
```