**DSD PROJECT REPORT**

**BATCH 1: WASHING MACHINE**

**TEAM 83**

**1.Requirements:**

**Required to implement a washing machine with 2 stages:**

1. Stage 1 is for rinsing the water.

2. Stage 2 for spinning the clothes.

**Tasks:**

1) The user needs to start the washing machine using a button or any equivalent.

2) The washing machine should pump the water using a water pump for a specific amount of time from your choice and then the water pump stops after that time, and this is marked as stage 1. Moreover, you should switch on a LED to determine that we are in stage 1.

3) The washing machine should spin the clothes using a motor after stage 1 is finished automatically. This should be indicated using another LED than that used in stage 1.

4) You should have a stop button to stop the washing machine.

**2.Hardware Devices Used:**

1.FPGA board

🡪 switch and 2 leds from the FPGA were used as outputs

2.Motor

3. Water pump

4.9v Battery

5. l298n motor driver

6. Breadboard and wires

**3.Main Idea:**

For the whole washing machine to work we used a switch 0 in the FPGA board to be the ON/OFF button. Any time the Switch is turned on the led 0 in the FPGA turn on and the water pump starts working for 20 seconds. After the 20 seconds pass the led 0 turn off declaring the end of the first stage and led 1 turns on to declare the start of the second stage, also the motor starts working at same time and don’t stop till we switch off switch 0 in the FPGA.

**4.CODE:**

library ieee;

use ieee.std\_logic\_1164.all;

use ieee.numeric\_std.all;

ENTITY DSDPROJ IS

generic(ClockFrequencyHz : integer :=10000000);

port(switch : in std\_logic;

Clk: in std\_logic;

nRst : in std\_logic;

LED1,LED2,PE,PE2,ME2,ME: out std\_logic);

END DSDPROJ;

architecture Behavior of DSDPROJ IS

signal Ticks: INTEGER ;

signal Seconds:Integer;

BEGIN

process(Clk) is

begin

if rising\_edge(Clk) then

-- If the negative reset signal is active

if switch = '0' then

Ticks <= 0;

Seconds <= 0;

LED1<='0';

LED2<='0';

PE<='0';

PE2<='0';

ME<='0';

ME2<='0';

else

-- True once every second

if Ticks = ClockFrequencyHz - 1 then

Ticks <= 0;

-- True once every minute

if Seconds = 59 then

Seconds <= 0;

else

Seconds <= Seconds + 1;

if Seconds<10 then

LED1<='1';

PE <='1';

PE2<='0';

else

LED1<='0';

PE<='0';

PE2<='0';

LED2<='1';

ME<='1';

ME2<='0';

end if ;

end if;

else

Ticks <= Ticks + 1;

end if;

end if;

end if;

end process;

END Behavior;

**5.Pin Assignment:**

1. clock 🡪PIN\_N5

2.LED1(output)🡪 PIN\_A8

2.LED2(output)🡪 PIN\_A9

3.ME(Motor)(output)🡪PIN\_V7

4.ME2(motor)(output)🡪PIN\_W7

5.PE (pump)(output)🡪PIN\_W8

6.PE2(pump)(output)🡪PIN\_V8

7.switch (input)🡪PIN\_C10

**6.Hardware connection :**

1. l298n motor driver: the 12volts and GND pins are connected to the 9V battery while the 4 input pins connected to the FPGA in GPIO Expansion Headers (GPIO\_[4] ,GPIO\_[5] ,GPIO\_[6] ,GPIO\_[7]) to get the pump and motor values. While Pump and motor wires are connected to the outputs of the l298n motor driver.

2.FPGA: connected the GND through the breadboard and also uses the switch for on/off. 2 Leds used

3.Water pump: Have been putted in a water glass for testing

4. Motor: have been connected to simple 4 edged wings to simulate the motion.

**7.Results:**

The moment the switch is turned on the led 0 turned on successfully and the water pump had pumped water successfully for 20 seconds as expected, then after the 20 seconds the pump had stopped working and led 0 turn off and motor started rotating and led 1 turned on. The motor kept spinning till the switch is turned off and the leds are all dark .