Faculty of Engineering

Project Title:
Controller For Water Treatment Factory

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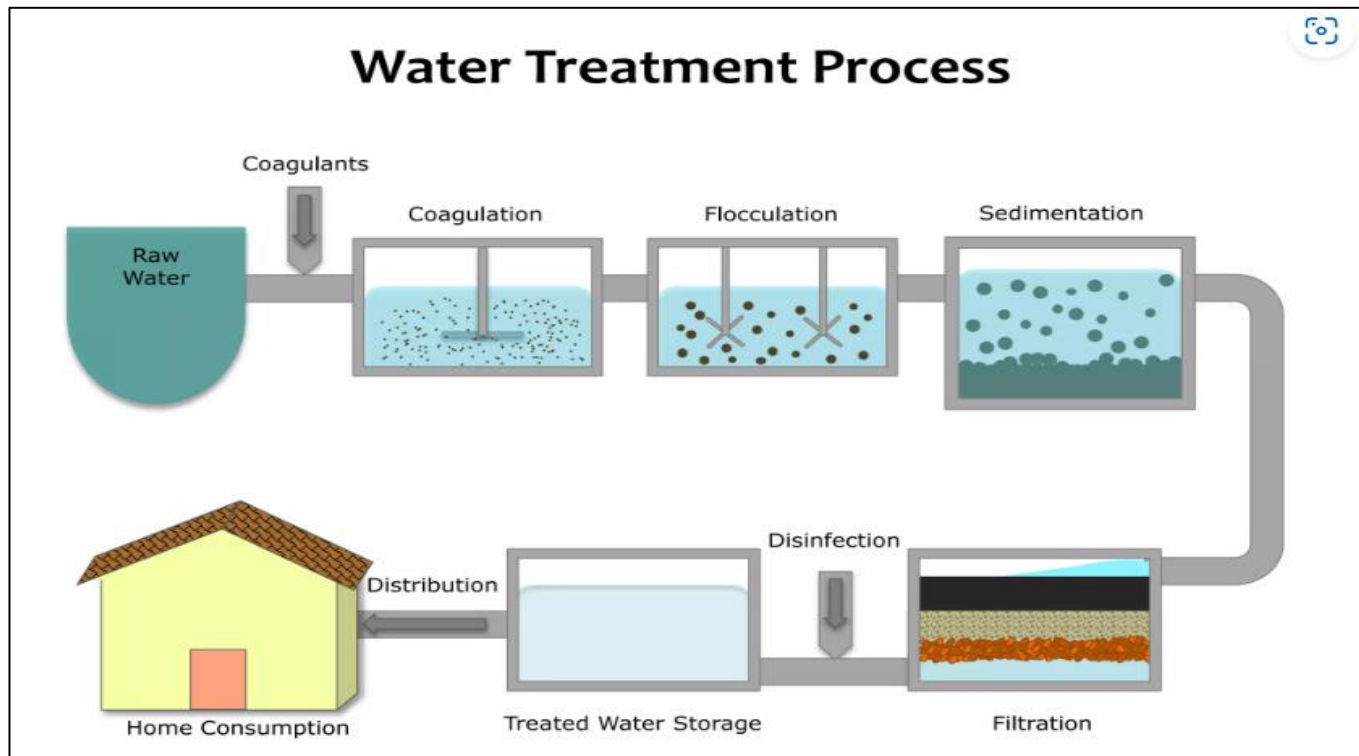
Water treatment process :-

- It is the process of removing unwanted substances and pathogens from water, The degree of treatment depends on the quality of water needed or required.
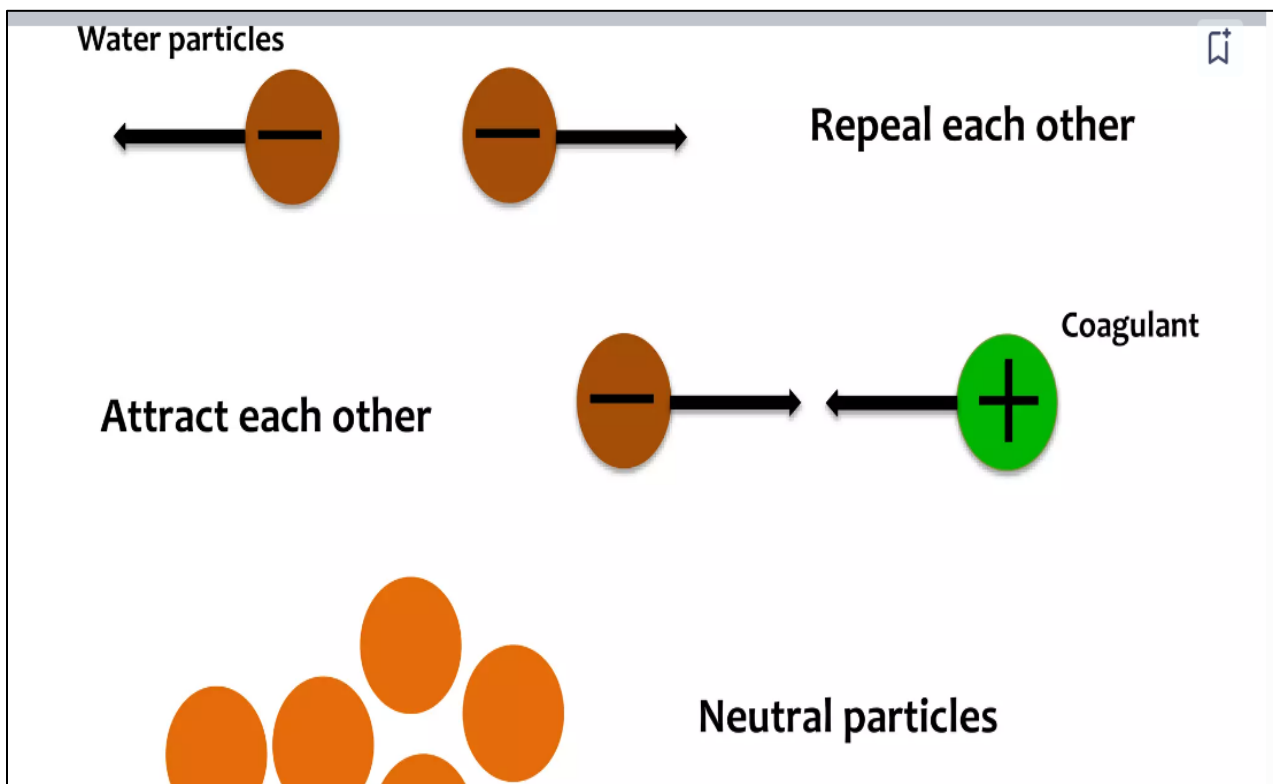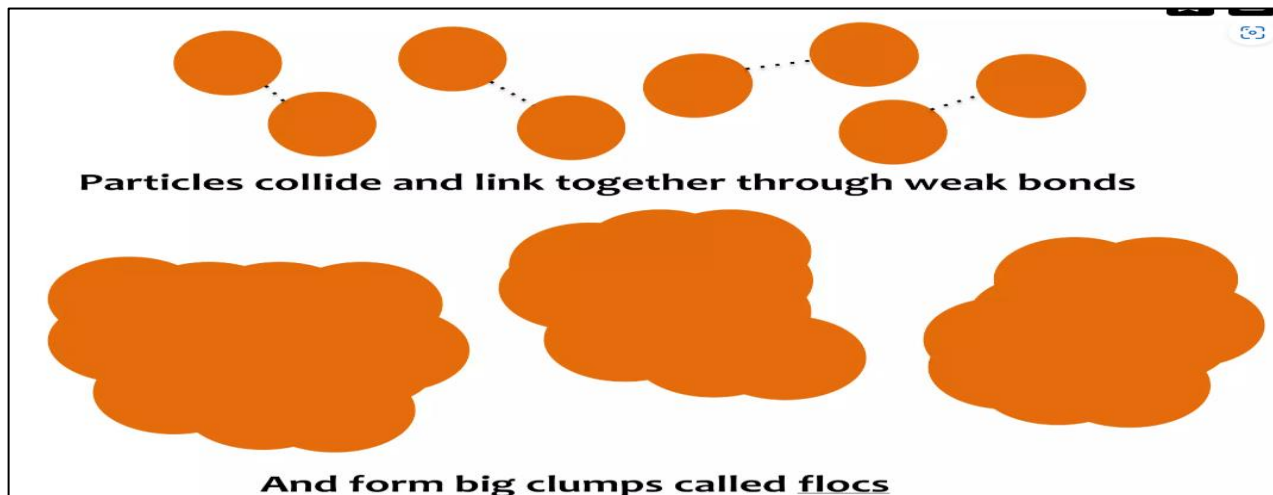
-The water treatment process usually includes the following steps:-

1- Coagulation
2- Flocculation
3- Sedimentation
4- Filtration
5- Disinfection

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Coagulation and flocculation

- There are often the first steps in water treatment,Positively charged chemicals are added to water, the positive charge of these chemicals neutralizes the negative charge of dirt and other dissolved particles in the water,When this happens the molecules bind to the chemicals and form larger molecules called floc .

Particles collide and link together through weak bonds

And form big clumps called flocs

Water particles

Repeal each other

Attract each other

Coagulant

Neutral particles

Sedimentation (or Clarification) :-

The water continues to the **<u>sedimentation</u>** basin, or clarifier, after the flocs have been formed, The goal of this stage of the treatment process is to reduce the amount of solids in the water before the water is filtered in the next treatment step.
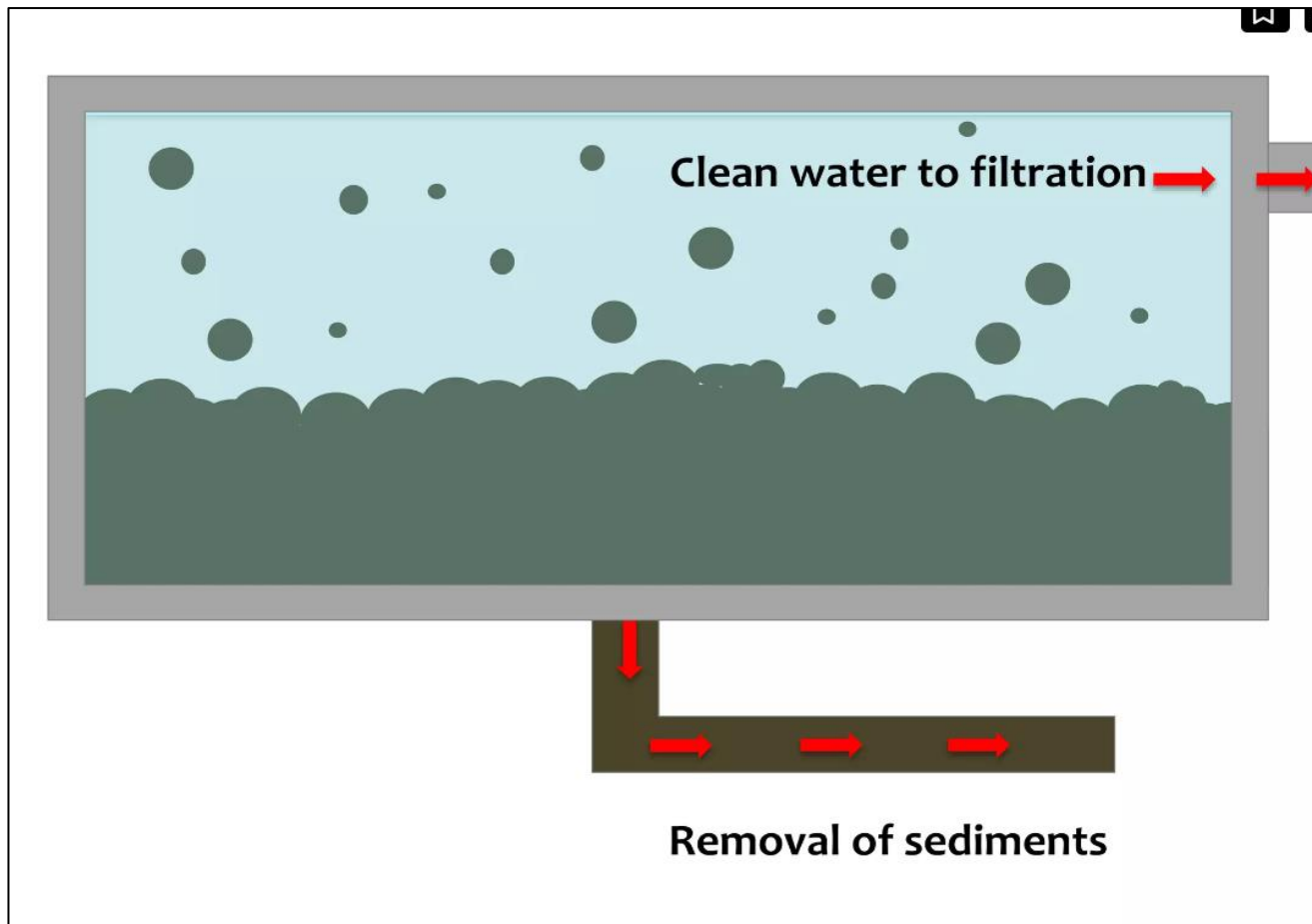

-The final water treatment process in removing particulates is **<u>filtration</u>**,
 the sedimentation process will have already removed a large percentage
 of the suspended solids.
 sedimentation is unable to remove many small particles in water though.

Filtration will remove these microorganisms and other **suspended material that did not settle out previously.**

Filtration

Water from sedimentation

Clean water to disinfection
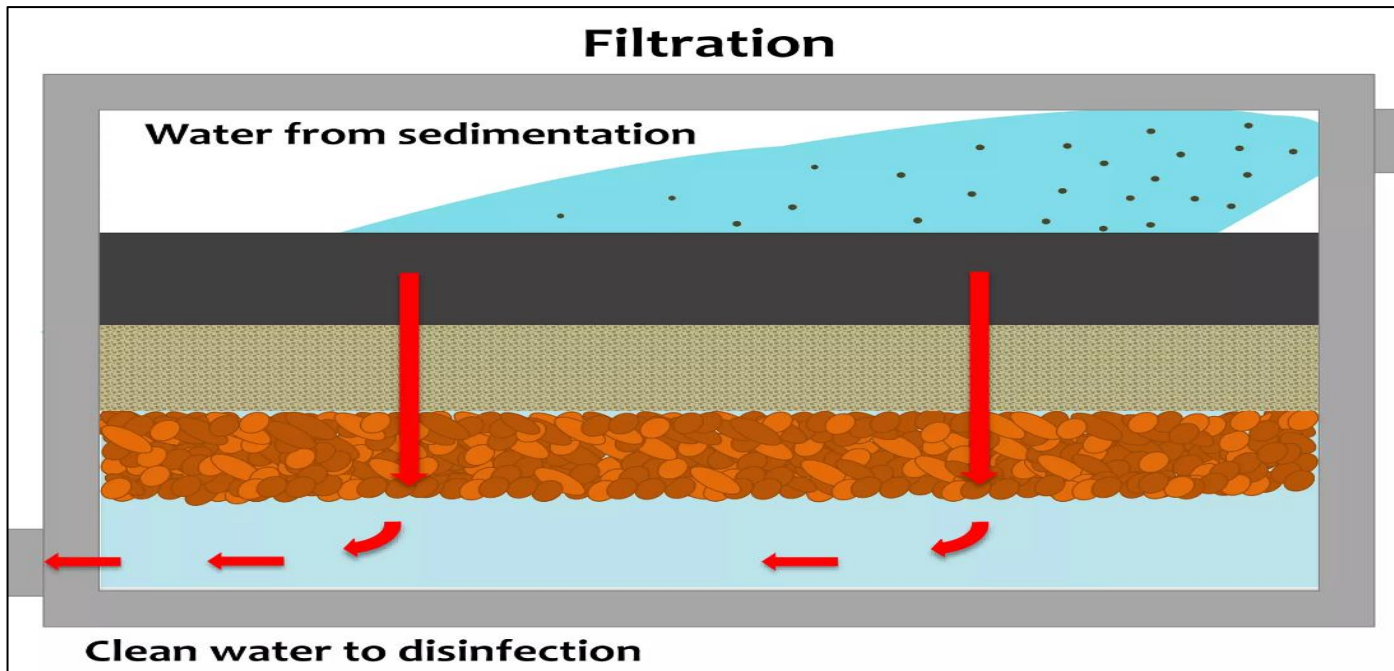
Chlorination Operations :-

Chlorination was one of the first drinking water disinfection methods, it is still the most commonly used disinfection method used today, the filtered water is injected with either liquid sodium hypochlorite, gaseous chlorine, or solid calcium hypochlorite.

Chlorine is a strong oxidant, it is used to both disinfect and also to remove color, taste and odor compounds, iron and manganese, and other dissolved inorganic contaminants such as arsenic .

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Disinfection

Disinfecting agents

Microorganisms remaining
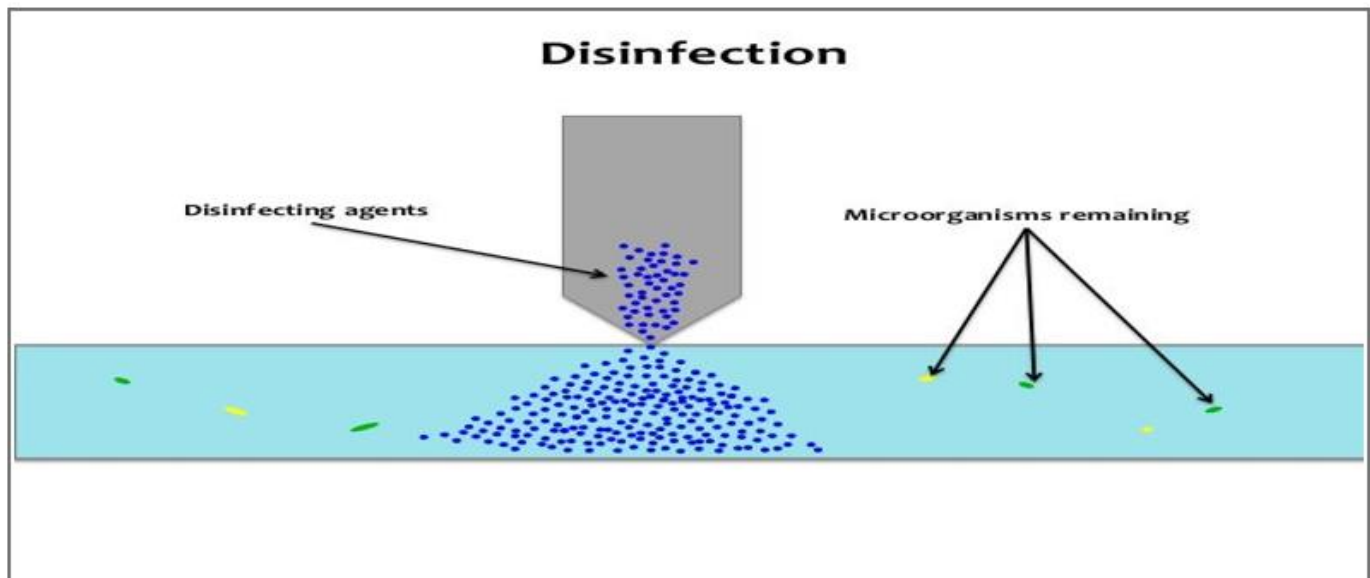
Conclusion

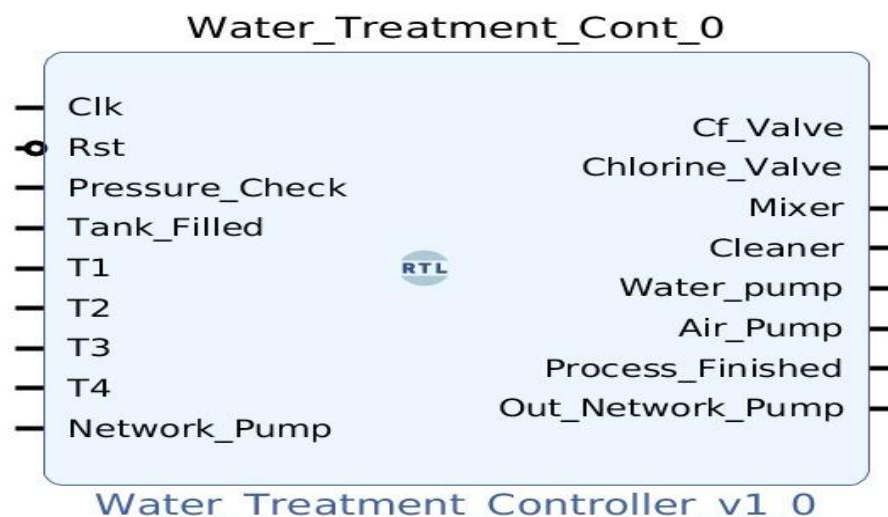Raw water comes from various sources such as lakes and rivers. Raw water if filled with harmful particles, therefore it must be treated before it is consumed. Going through the water treatment, raw water is filtered and disinfected to kill off and clean out all of the harmful particles. The water is then distributed throughout the society for various uses by humans.

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- In order to mechanize the water treatment process, we followed these steps :-

- **S0** We wait until the tank is filled and do not move to **S2** until the tank is filled through TF and PC sensor.
- **S١** We add the special mod(**Coagulation and flocculation**) We activate the blender until this mod spreads and wait for a while T.
- **S2** we close the mixer and the material pump for Coagulation and flocculation)Transfer the water to a new tank through a water pump and wait until the new tank is full TF&PC .
- **S3** **Sedimentation** we wait some time and do **cleaner open , air pump open** and close **the water pump** .
- **S4** **Sedimentation** end and Transfer the water to a new tank through a water pump and wait until the new tank is full TF&PC .
- **S5** filter start water pump close .
- **S6** filter end and Transfer the water to a new tank through a water pump and wait until the new tank is full TF&PC.
- **S6** disinfection methods open the material pump for Chlorine close water pump wait T time .
- **S8** after T time process ended and water pump close the material pump for Chlorine close .
- We can take clean water from network pump .

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- ## RTL View Of Chip

Water_Treatment_Cont_0

Water_Treatment_Controller_v1_0

ASM Chart Of Controler For Watertreatment Factory

S0 — Initial State

TF = PC = 1

S1: Coagulation & Flocculation Process starts
- CF Valve = 1
- Mixer = 1
- Water Pump = 0

T1

S2: Coagulation & Flocculation Process ends
- CF Valve = 0
- Mixer = 0
- Water Pump = 1

TF = PC = 1

S3: Sedimentation Process starts
- Cleaner = 1
- Air Pump = 1
- Water Pump = 0

T2

S4: Sedimentation Process ends
- Cleaner = 0
- Air pump = 0
- water pump = 1

TF = PC = 1

S5: Filtration Process starts
- Water Pump = 0

T3

S6: Filtration Process ends
- Water Pump = 1

TF = PC = 1

S7: Disinfection Process starts
- chlorine valve = 1
- water pump = 0

T4

Process Finished

S8: Disinfection Process ends
- chlorine valve = 0
- water pump = 0

Network pump = 1

Out Network pump

Code :-

```
-------------------------------------------------------------------------------
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_arith.ALL;
use IEEE.STD_LOGIC_unsigned.ALL;
-------------------------------------------------------------------------------
                --------Entity definition----------
entity Water_Treatment_Controller is
  port(
                -----sequential Circuit--------
        Clk , Rst  : in  std_Logic;
                -------Primary Input---------
  Pressure_Check,Tank_Filled   : in  std_logic;
  T1,T2,T3,T4                   : in  std_logic;
  Network_Pump                 : in  std_logic;
                -------Primary Output--------
  Cf_Valve,Chlorine_Valve      : out std_Logic;
  Mixer                        : out std_Logic;
  Cleaner                      : out std_Logic;
  Water_pump                   : out std_Logic;
  Air_Pump                     : out std_Logic;
  Process_Finished             : out std_Logic;
  Out_Network_Pump             : out std_Logic);
end Water_Treatment_Controller;
                -------Architecture definition------
architecture behavioral of Water_Treatment_Controller is
                -------State definition------------
type state is (s0,s1,s2,s3,s4,s5,s6,s7,s8);
signal Present_state,Next_state : state;
begin
                -------Sequential Circuit--------
  Seq : process(Clk)
  begin
        if (Rising_edge(Clk))  then
                if (Rst = '0') then
                        Present_state<=s0;
                else
```

```
                    Present_state<=Next_state;
              end if;
         end if;
   end process Seq;
-------------------------------------------------------------------------
              ----------combinational Circuit------------

 Comb : process(Present_state,T1,T2,T3,T4,Pressure_Check
         ,Tank_Filled,Network_Pump)

 begin
 case Present_state is
-------------------------------------------------------------------------

  when S0 =>
       Cf_Valve <= '0';  Chlorine_Valve <= '0';
       Mixer <= '0';    Cleaner <= '0';
       Water_pump <= '0';  Air_Pump <= '0';

       Process_Finished<='0';
       Out_Network_Pump<='0';
       if((Pressure_Check='1')and(Tank_Filled='1'))then
            Next_state<=S1;
       else
            Next_state<=S0;
       end if;
-------------------------------------------------------------------------
   when S1 =>
       Cf_Valve  <='1';
       Mixer    <='1';
       Water_pump<='0';
       if(T1='1')then
            Next_state<=S2;
       else
            Next_state<=S1;
       end if;
-------------------------------------------------------------------------
```

```
    when S2 =>
          Cf_Valve  <='0';
          Mixer     <='0';
          Water_pump<='1';
          if((Pressure_Check='1')and(Tank_Filled='1'))then
                  Next_state<=S3;
          else
                  Next_state<=S2;
          end if;
------------------------------------------------------------------------------
    when S3 =>
          Cleaner   <='1';
          Air_Pump  <='1';
          Water_pump<='0';
          if(T2='1')then
                  Next_state<=S4;
          else
                  Next_state<=S3;
          end if;
------------------------------------------------------------------------------
    when S4 =>
          Cleaner   <='0';
          Air_Pump  <='0';
          Water_pump<='1';
          if((Pressure_Check='1')and(Tank_Filled='1'))then
                  Next_state<=S5;
          else
                  Next_state<=S4;
          end if;
------------------------------------------------------------------------------
    when S5 =>
          Water_pump<='0';
          if(T3='1')then
                  Next_state<=S6;
          else
                  Next_state<=S5;
          end if;
```

```
--------------------------------------------------------------------------
    when S6 =>
        Water_pump<='1';
        if((Pressure_Check='1')and(Tank_Filled='1'))then
                Next_state<=S7;
        else
                Next_state<=S6;
        end if;
--------------------------------------------------------------------------
    when S7 =>
        Water_pump   <='0';
        Chlorine_Valve<='1';
        if(T4='1')then
                Process_Finished<='1';
                Next_state<=S8;
        else
                Next_state<=S7;
        end if;
--------------------------------------------------------------------------
    when S8 =>
        Water_pump   <='0';
        Chlorine_Valve<='0';
        if(Network_Pump='1')then
                Out_Network_Pump<='1';
                Next_state<=S0;
        else
                Next_state<=S8;
        end if;


end case;
end process Comb;
end behavioral;
--------------------------------------------------------------------------
```

- this is our link video : https://www.youtube.com/watch?v=0_ZcCqqpS2o