Real Time simulation of Tank level control system using Open Modelica done by CDAC-T

Tank Level Control System

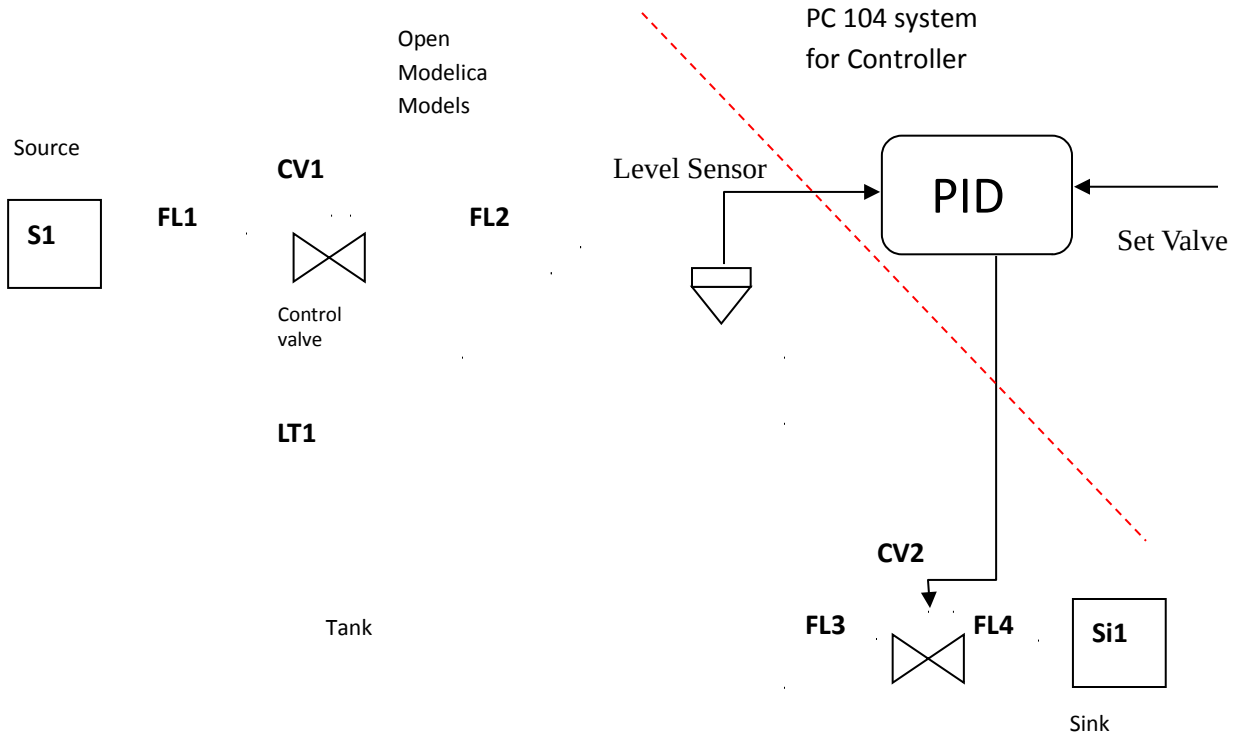


figure 1

Real-Time Simulation Set up

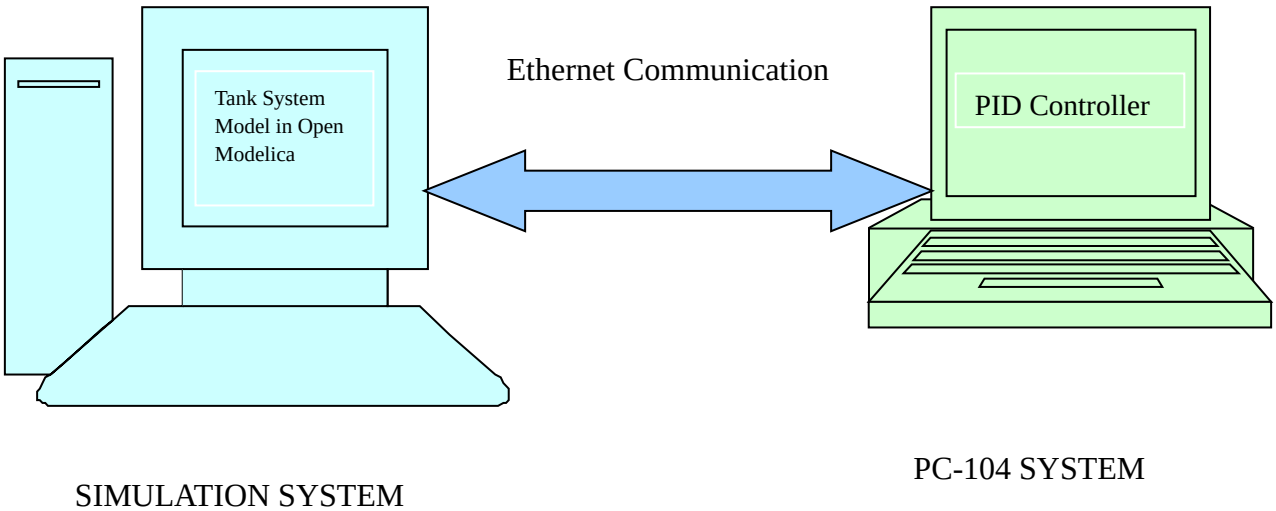
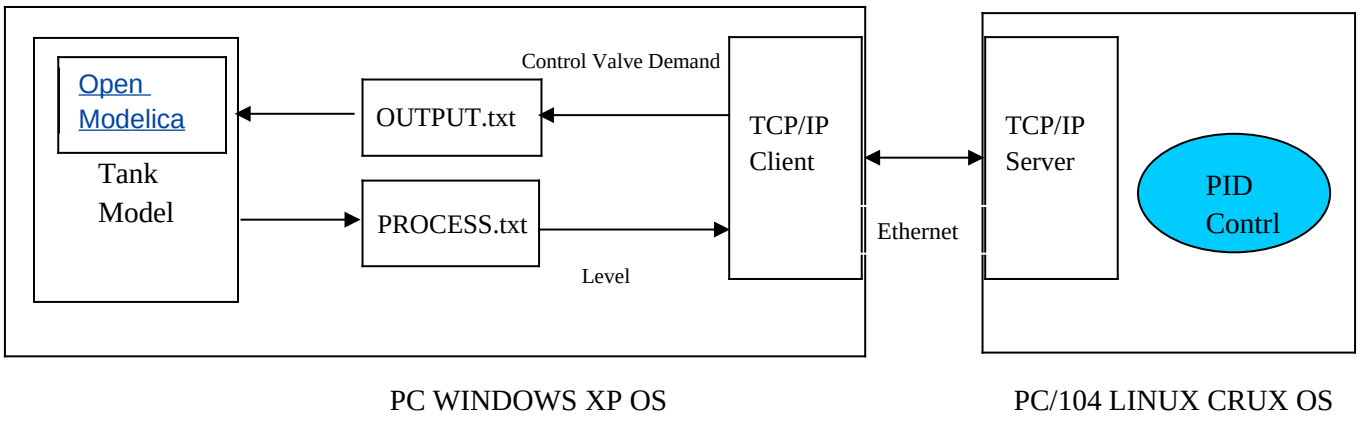


figure 2

Interface of Open Modelica Model with PC104 PID Controller with TCP Protocol: Simulation setup



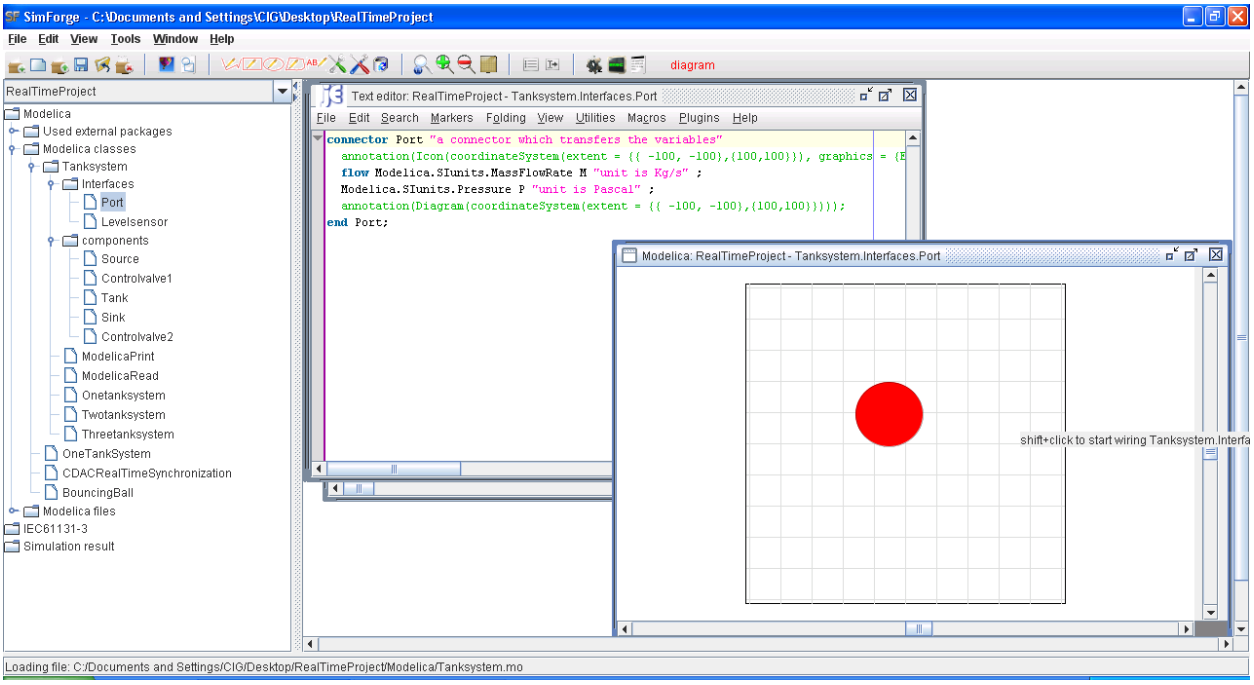
PC/104 – Embedded controller (compact PC)

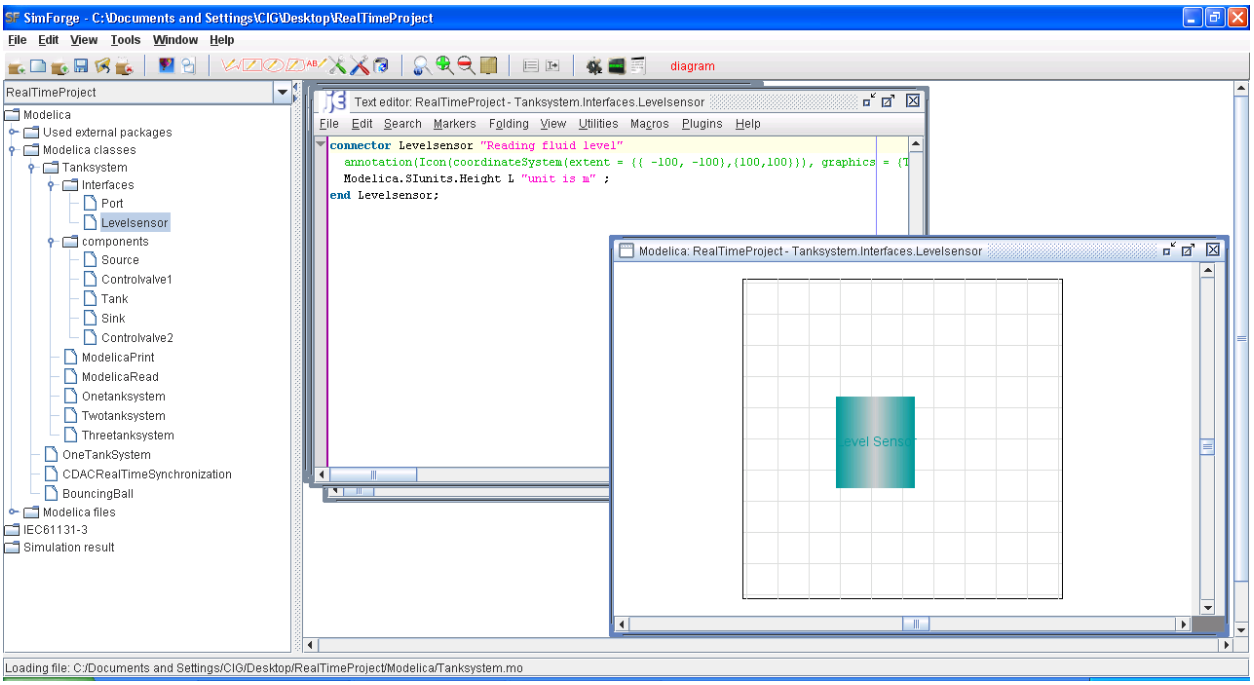
figure 3

Procedure for Simulation in Real Time using Open Modelica

1. The tank level control system shown in figure 1, is mathematically modeled by dividing it into following sub-components: (a) Port (b) Level sensor (c) Source (d) Control valve1 & 2 (e) Tank and (f) Sink

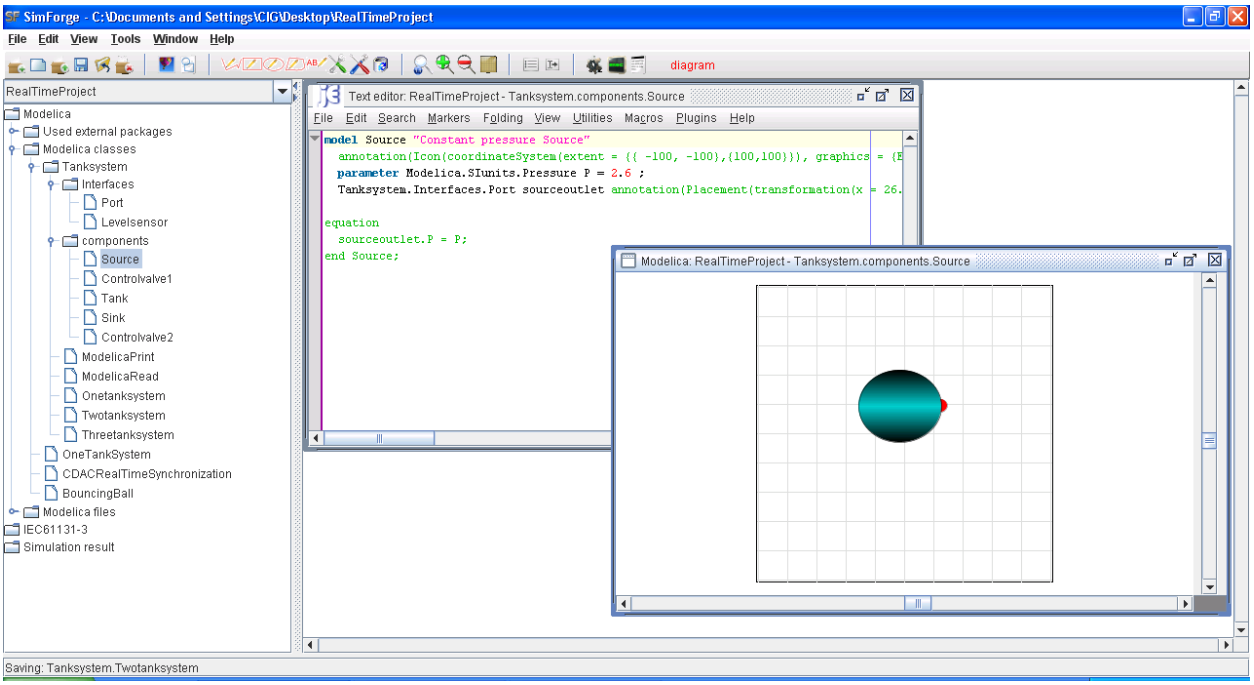
2. The Port and Level sensor components are made as part of Interfaces package. The individual components can have a graphical representation as shown.



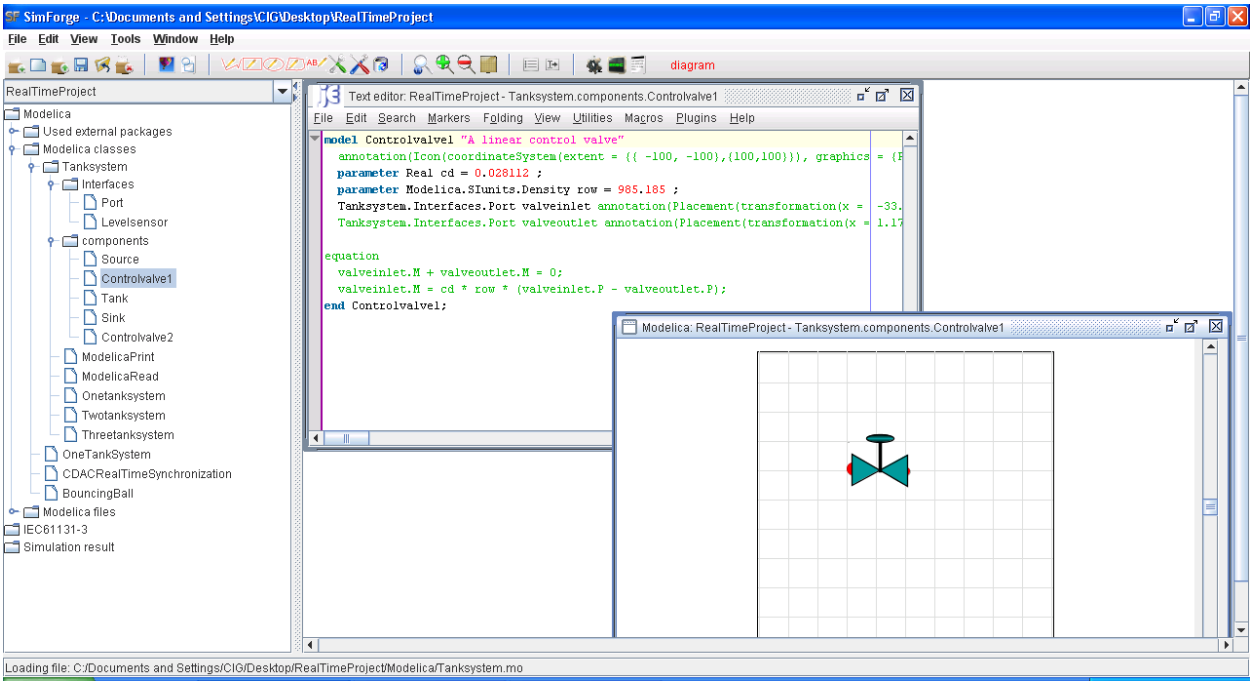


3. The Components package is made which contains Source, Control Vale1, Tank, Control valve 2, and Sink as sub-components.

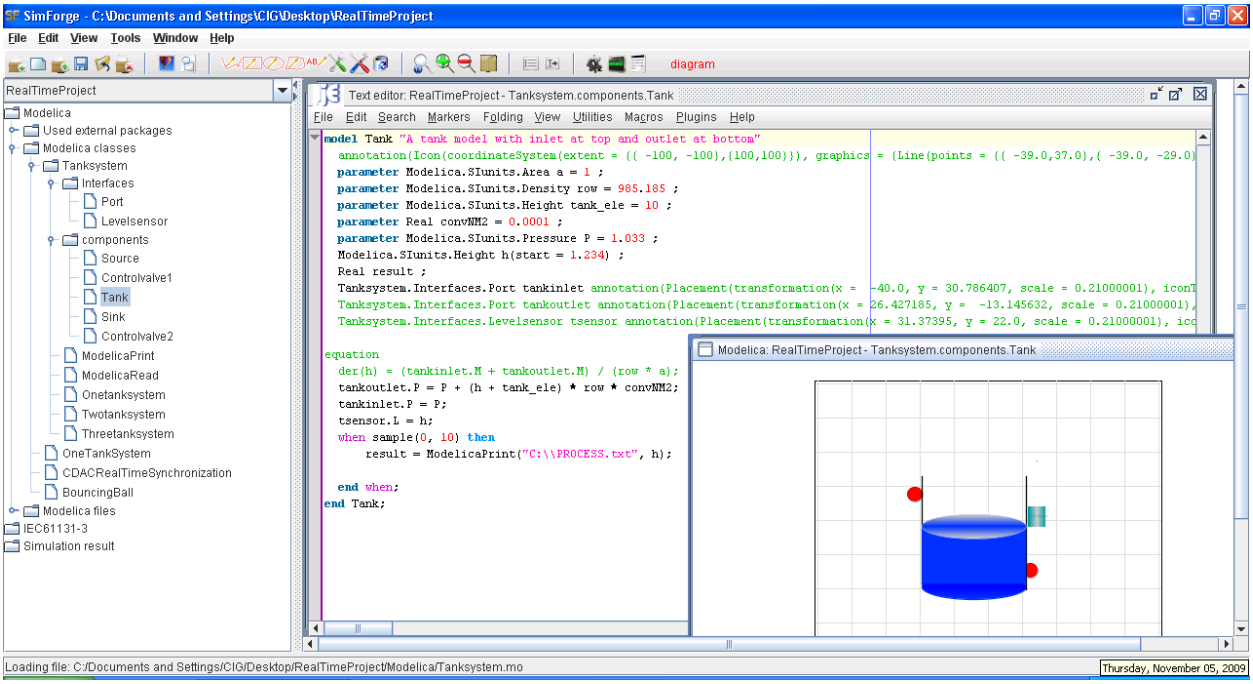
4. The Source component with its graphical representation.



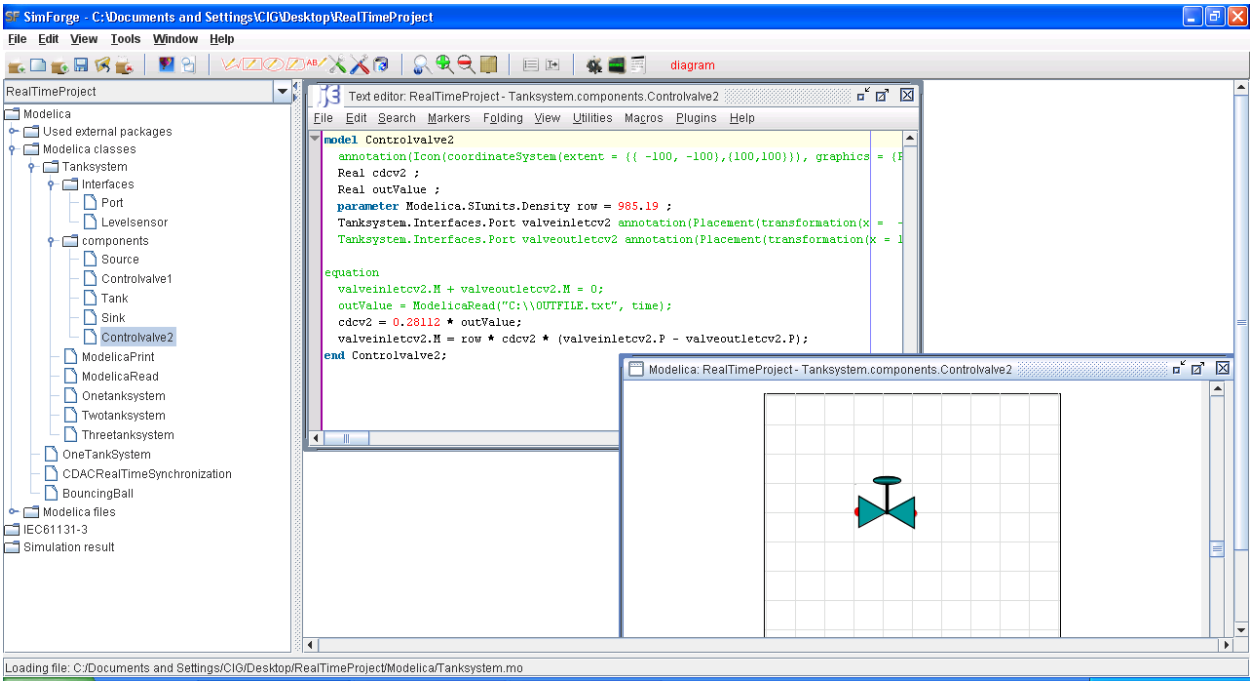
5. The Control valve 1 component with its graphical representation.



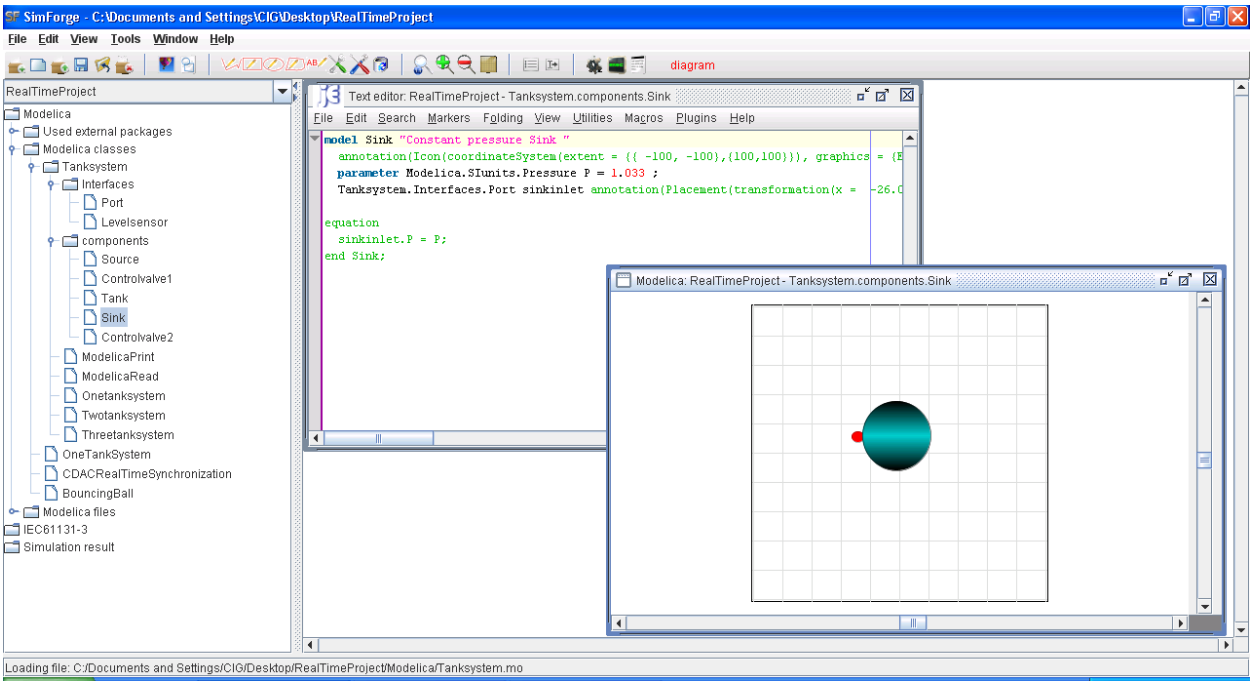
6. The Tank component with its graphical representation.



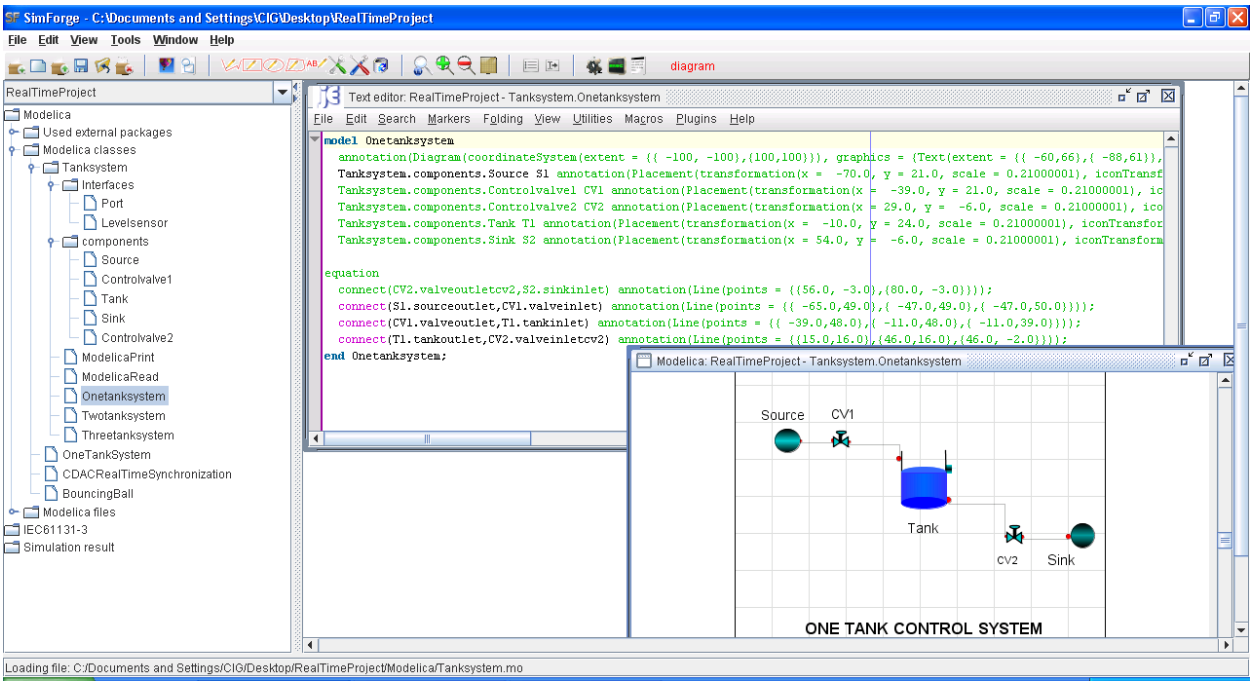
7. The Control valve 2 component with its graphical representation.

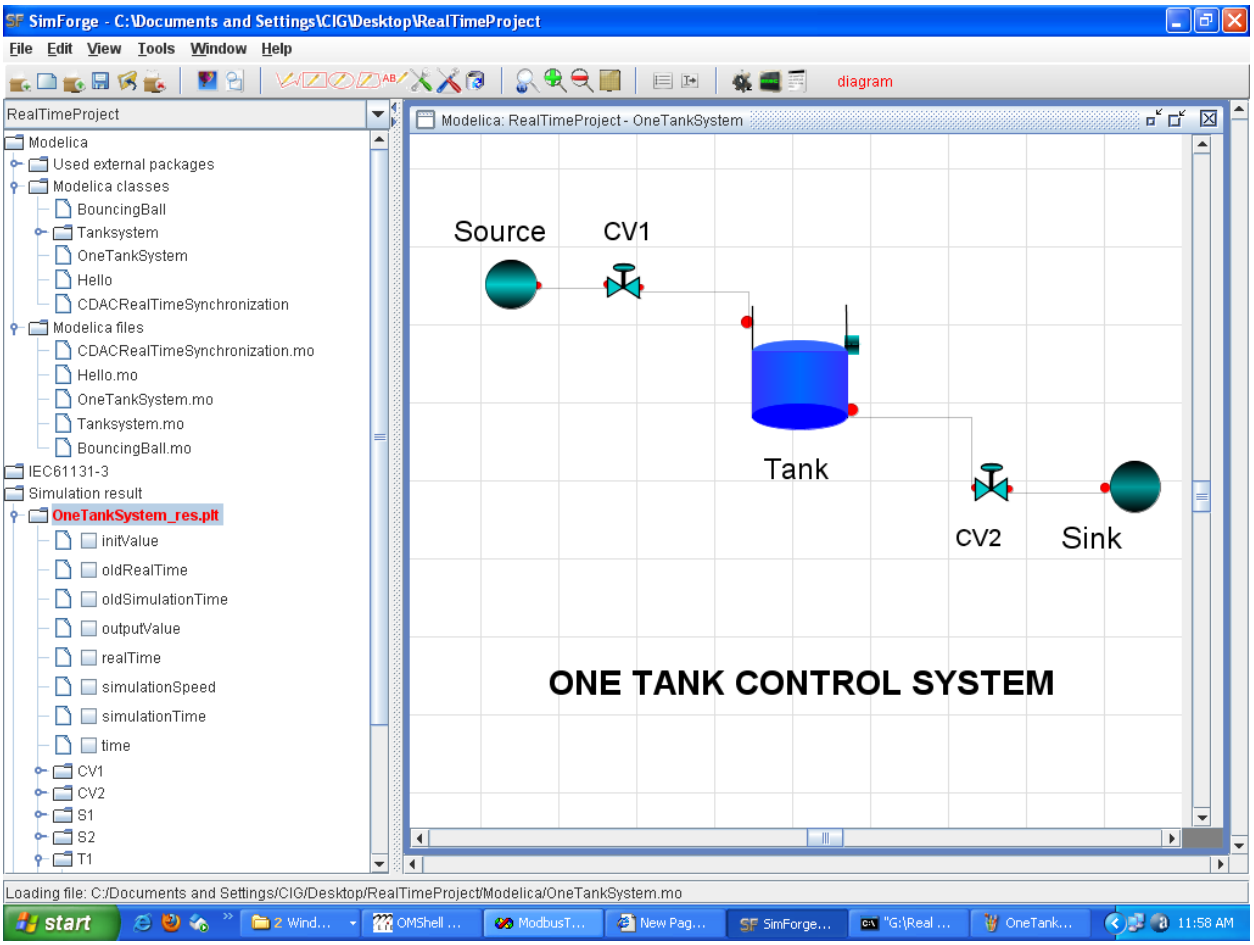


8. The Sink component with its graphical representation.

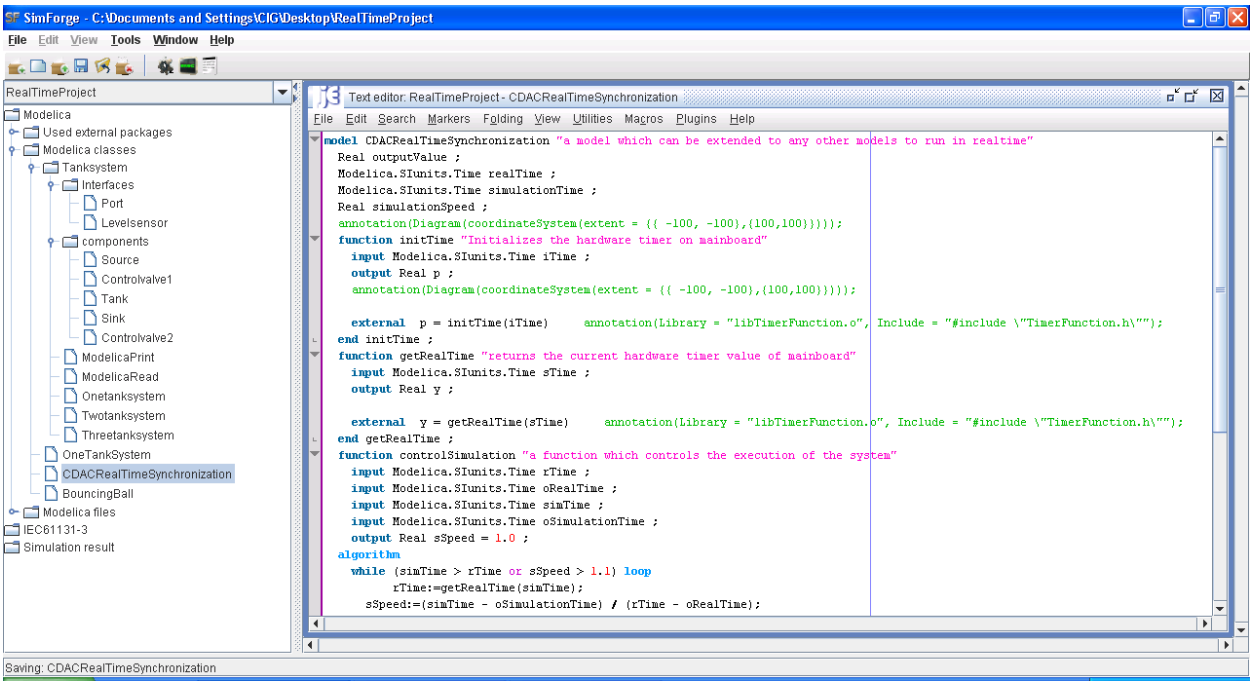


9. The One Tank System will be formed by suitably connecting the components. In graphical mode, if we drag and drop the components and connect them, the textual code will be generated.

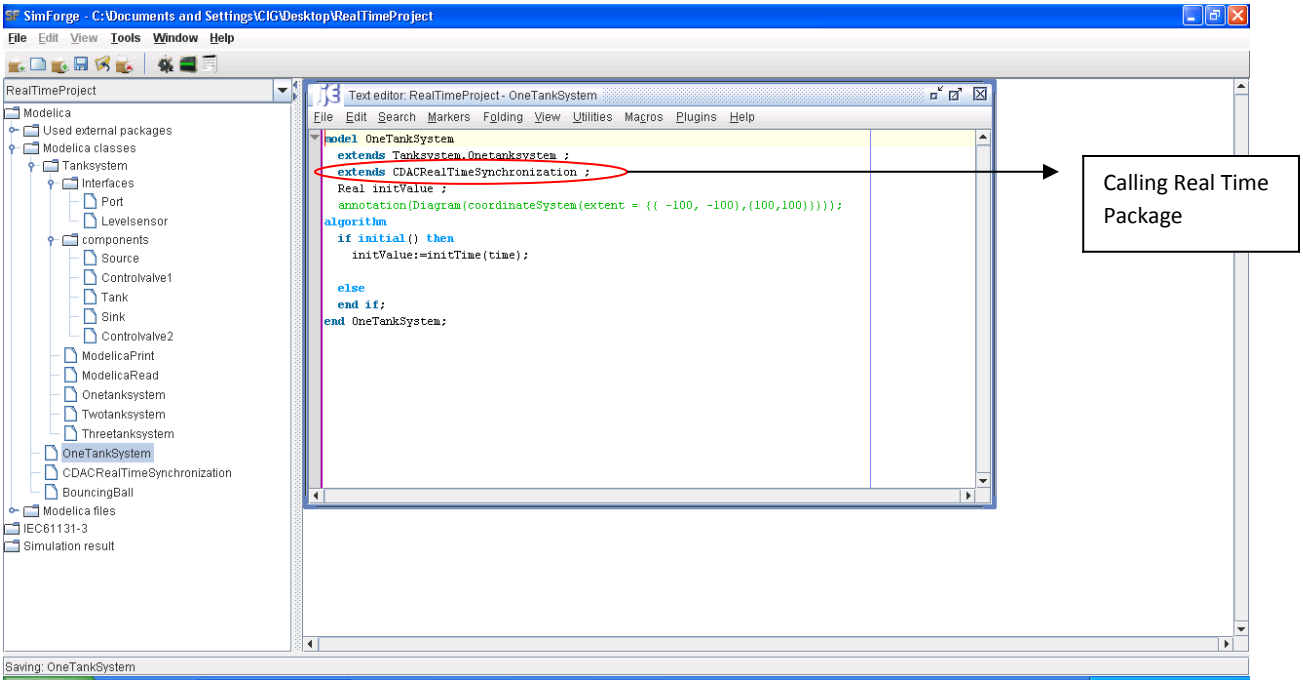




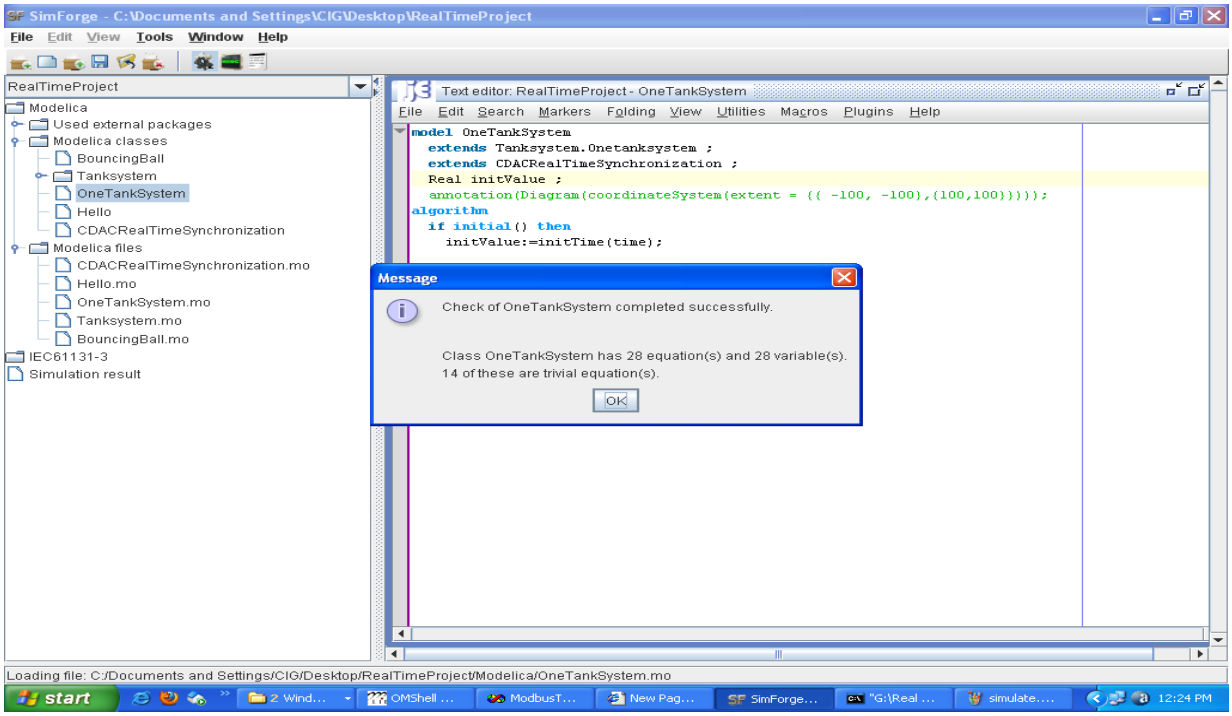
10. The Real Time Synchronization package is made as a package.



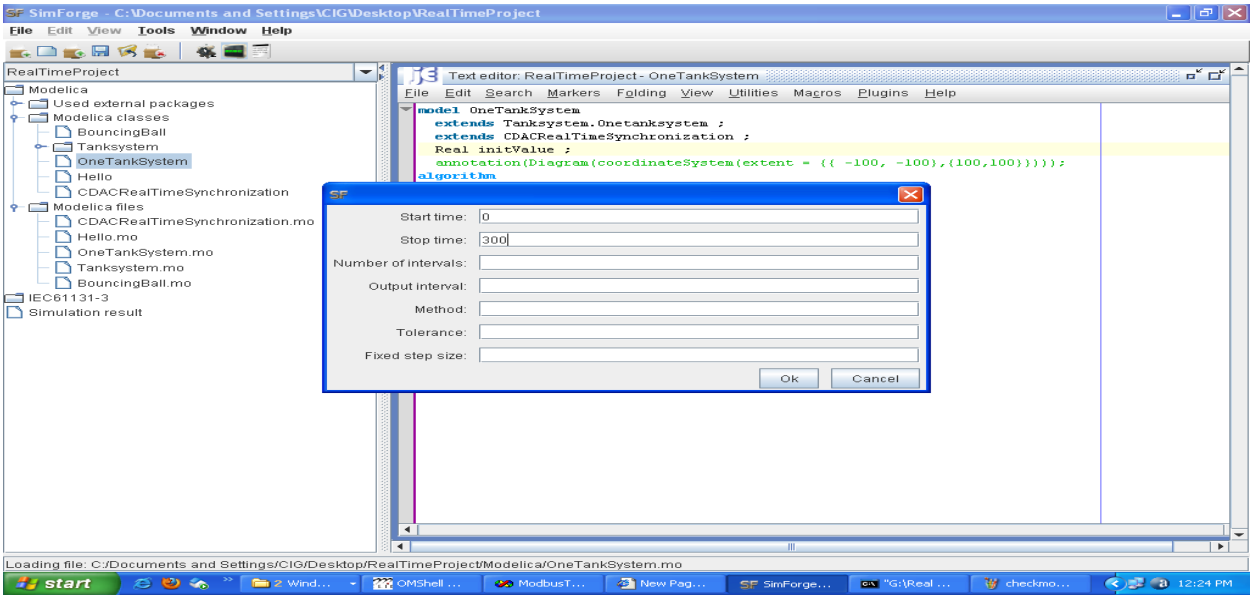
11. To achieve simulation in real time, we have to integrate it in one tank system.



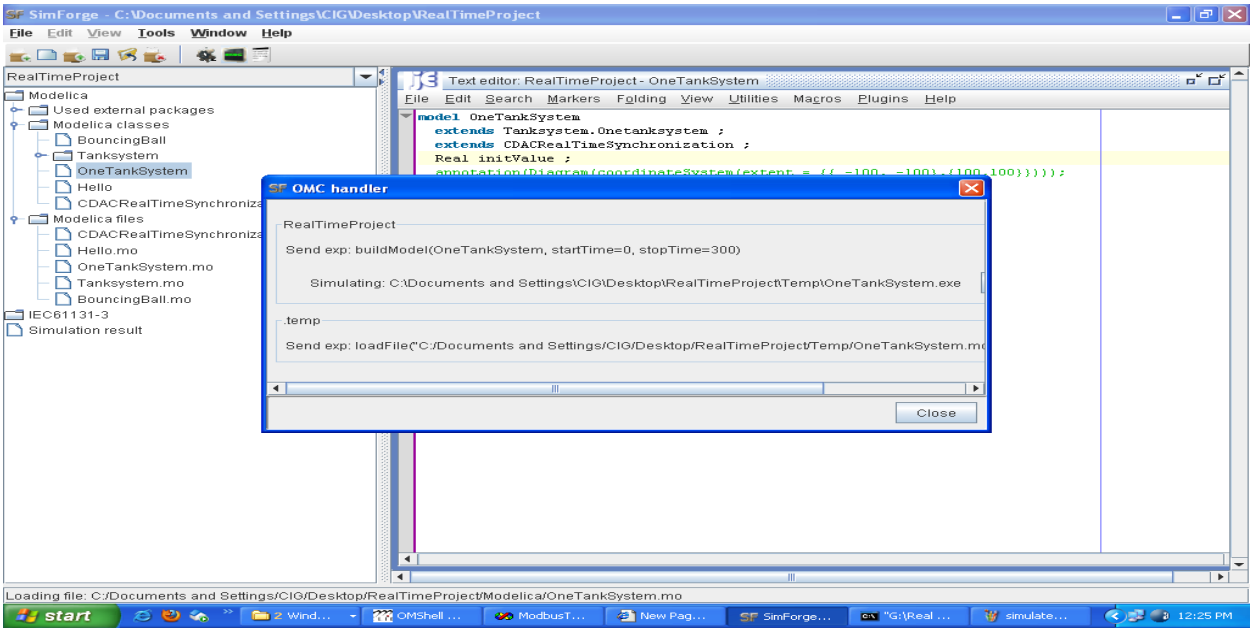
12. To run the simulation, the model should have same number of equations as the number of variables. The 'check model' option is used for it.



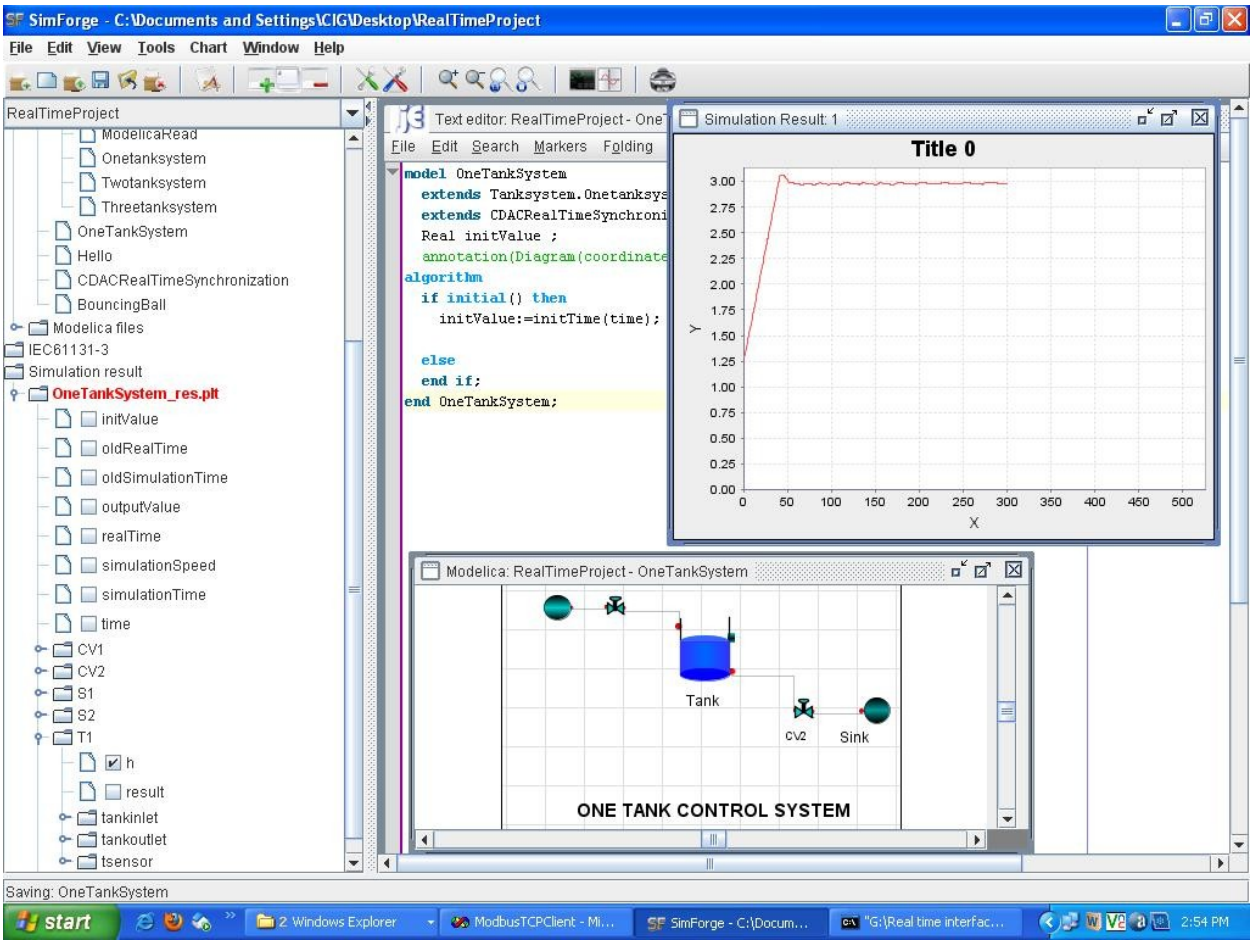
13. Now we can run the simulation. We have configure Start time and stop time.



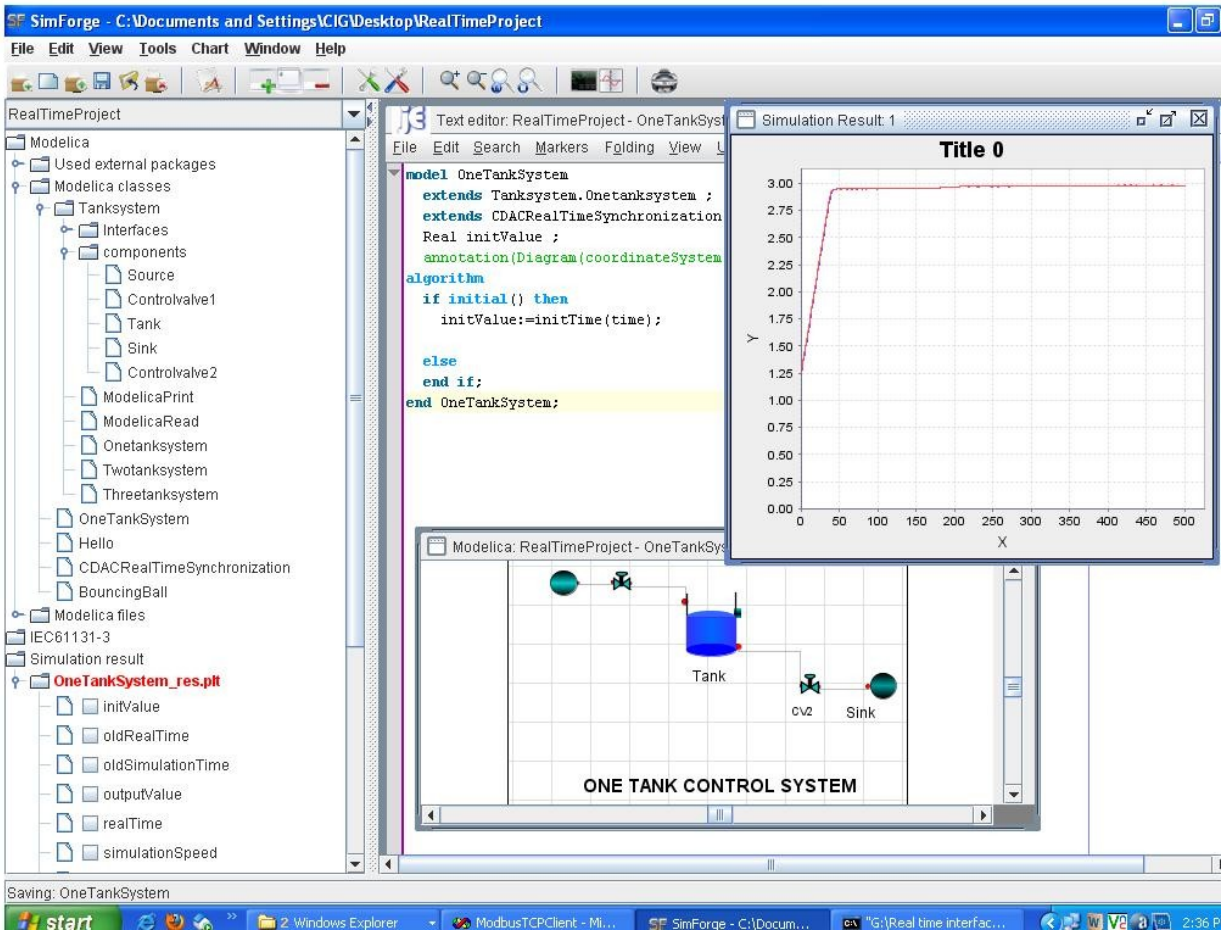
14. During simulation we can start a counter to check the real time. If we have given stop time of 60 sec, then the simulation should take exact 60 sec only.



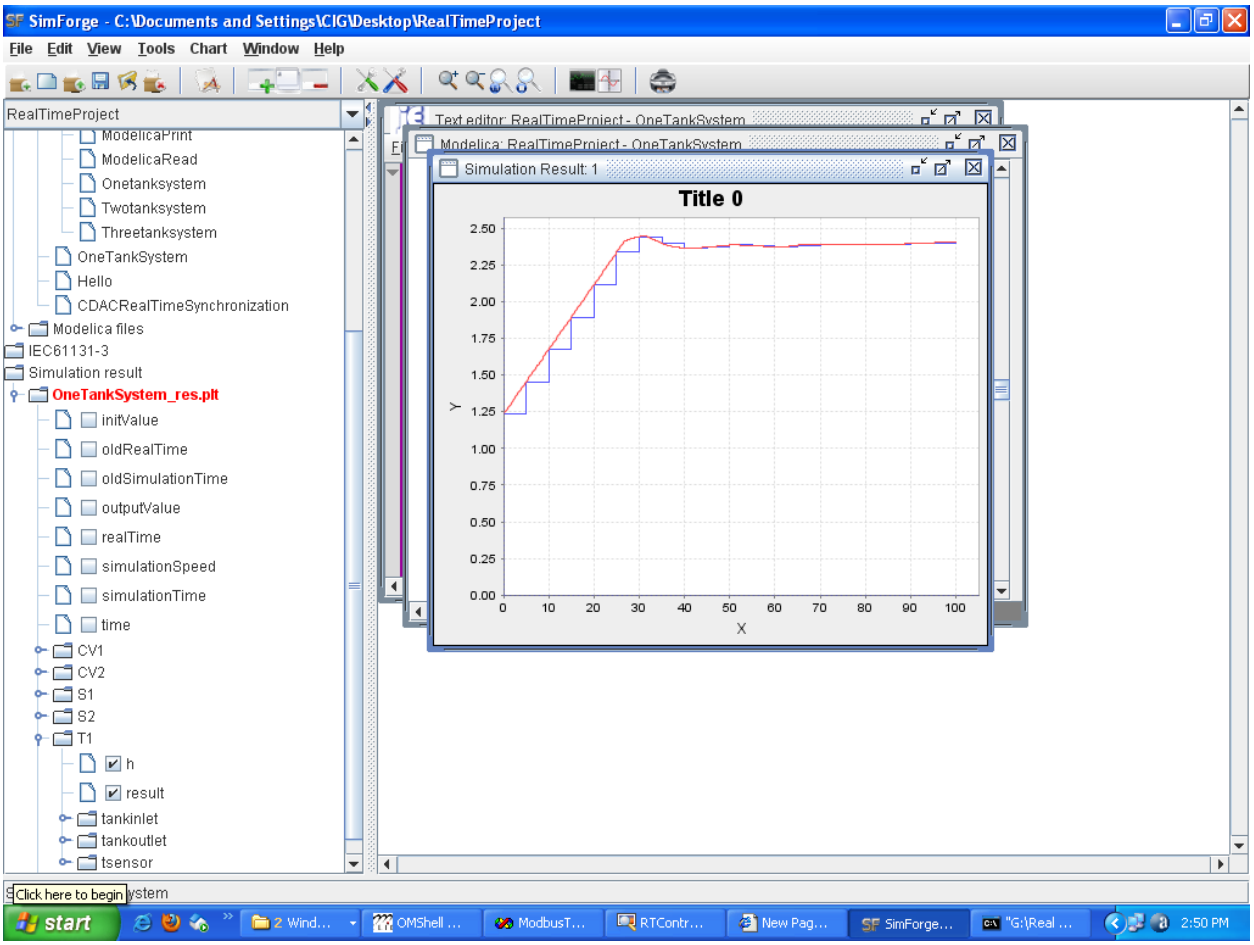
15. The simulation results can be plotted. Any variable in model can be plotted. Sampling time=0.5 sec; Set point =3.00 m; Stop time=300 sec



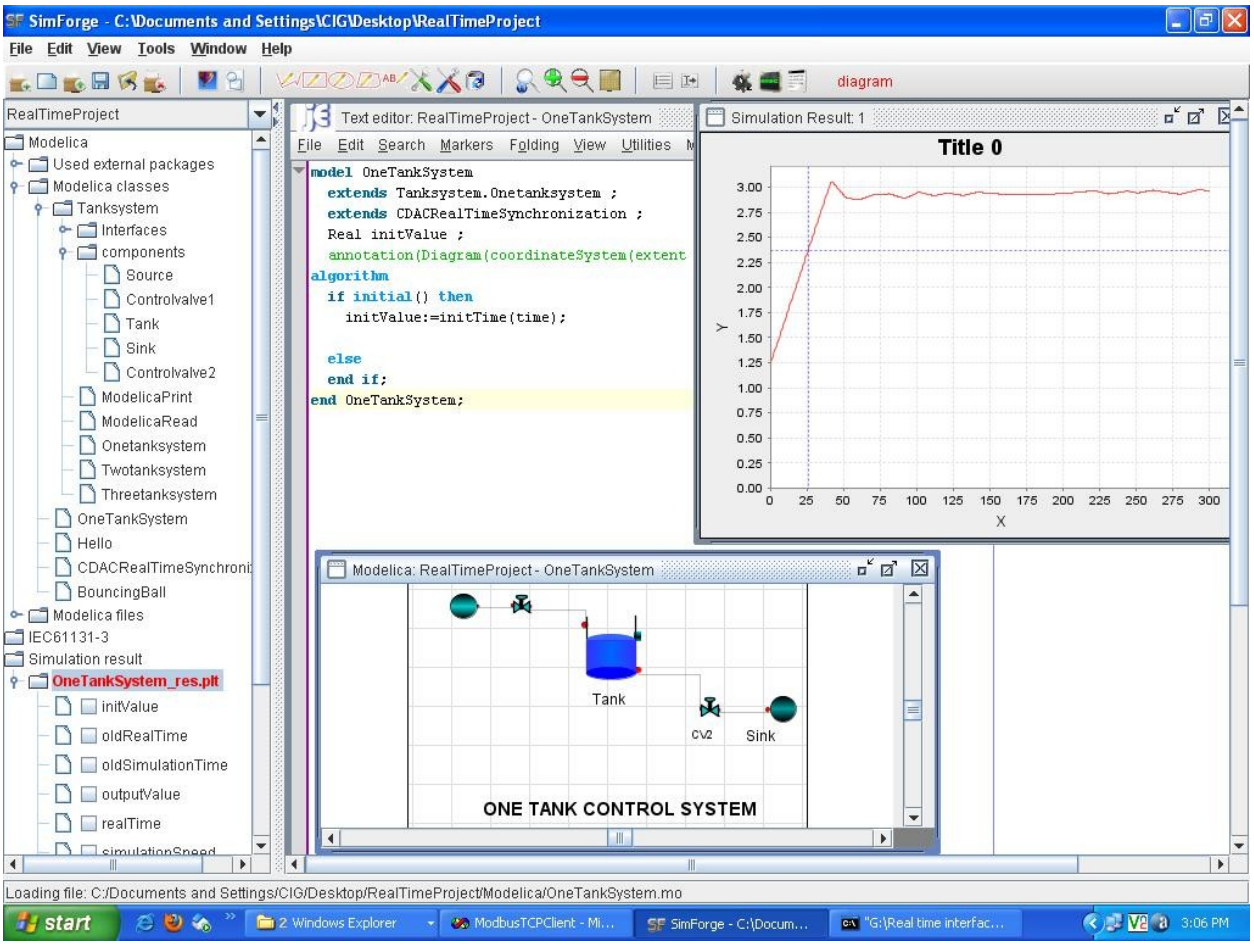
Sampling time=1 sec; Set point =2.50 m; Stop time=500 sec



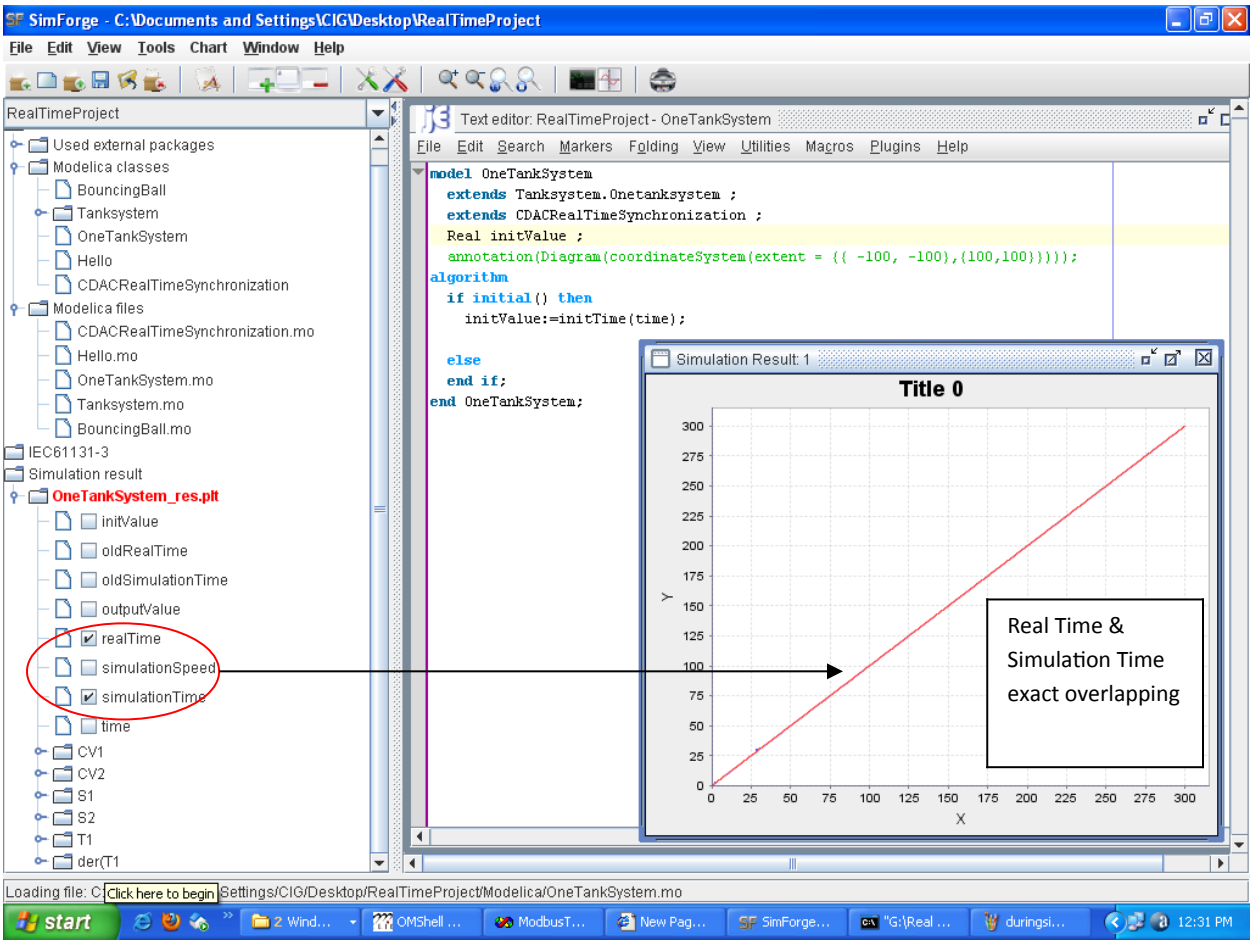
Sampling time=5 sec; Set point =2.50 m; Stop time=100 sec



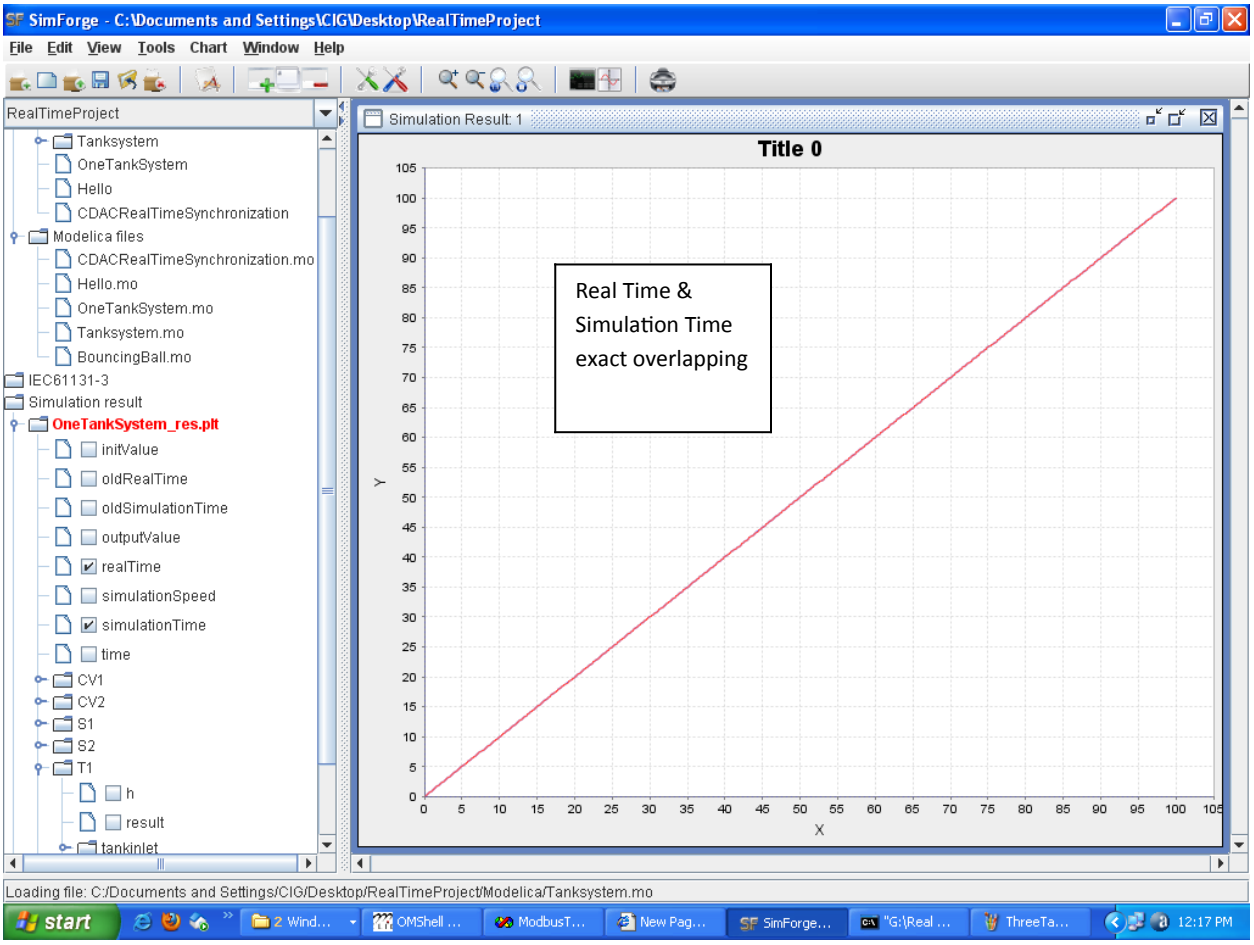
Sampling time=10 sec; Set point =3.00 m; Stop time=300 sec



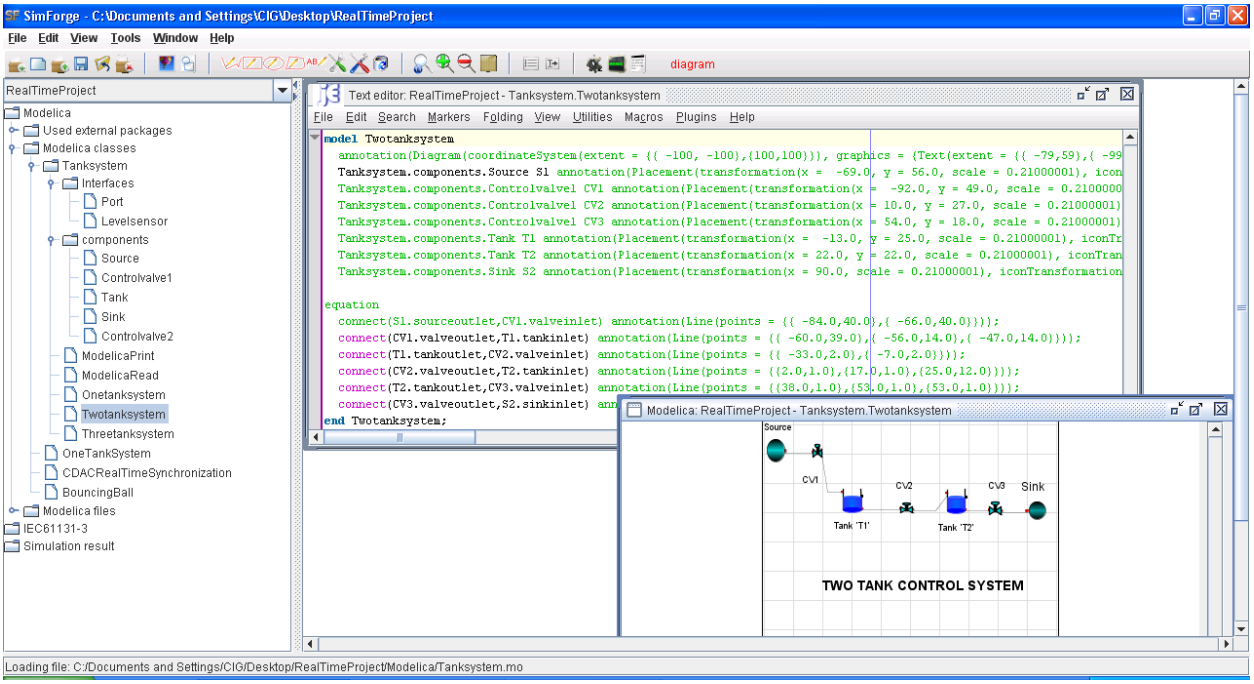
16. The simulation will take exactly 300 sec as configured. The Real time and Simulation time are exactly overlapping.

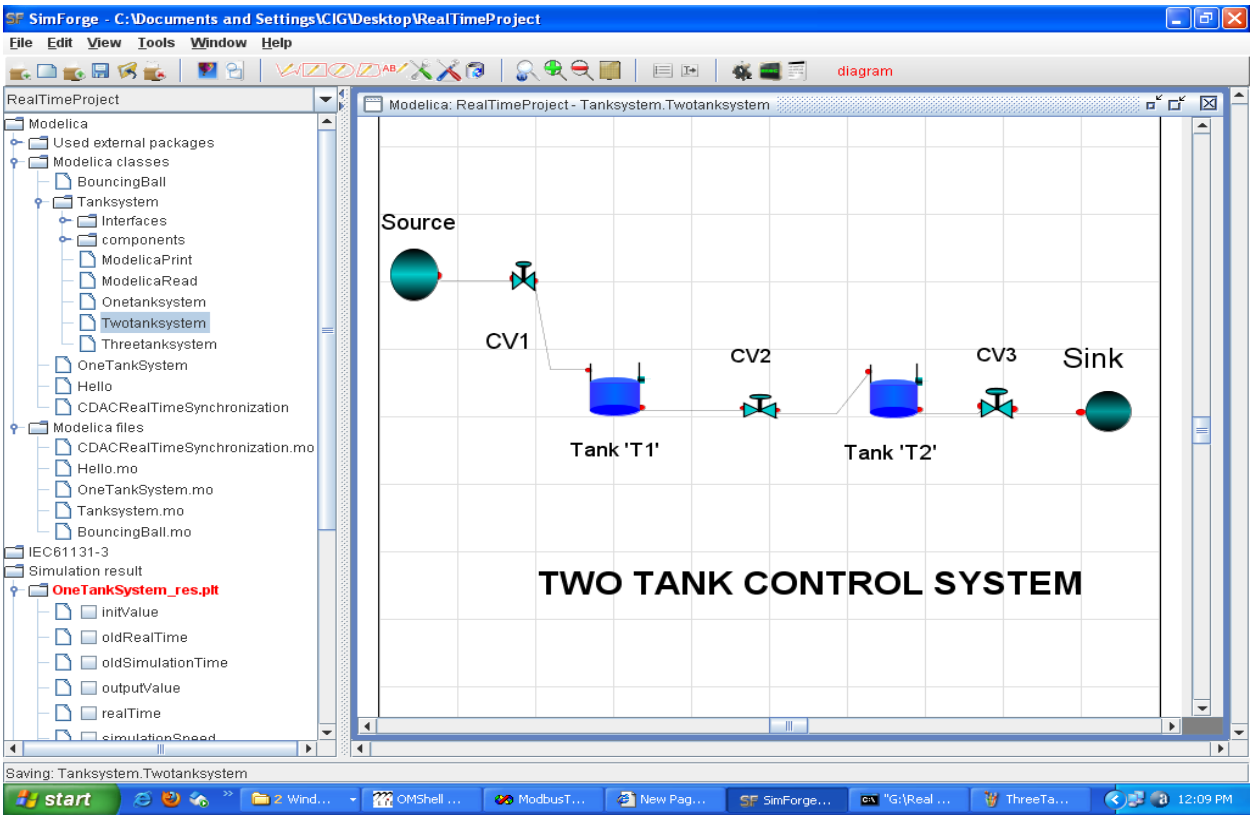


The Real time and Simulation time are exactly overlapping (simulation run for 100 sec).



17. The two tank system is modeled in open modelica.

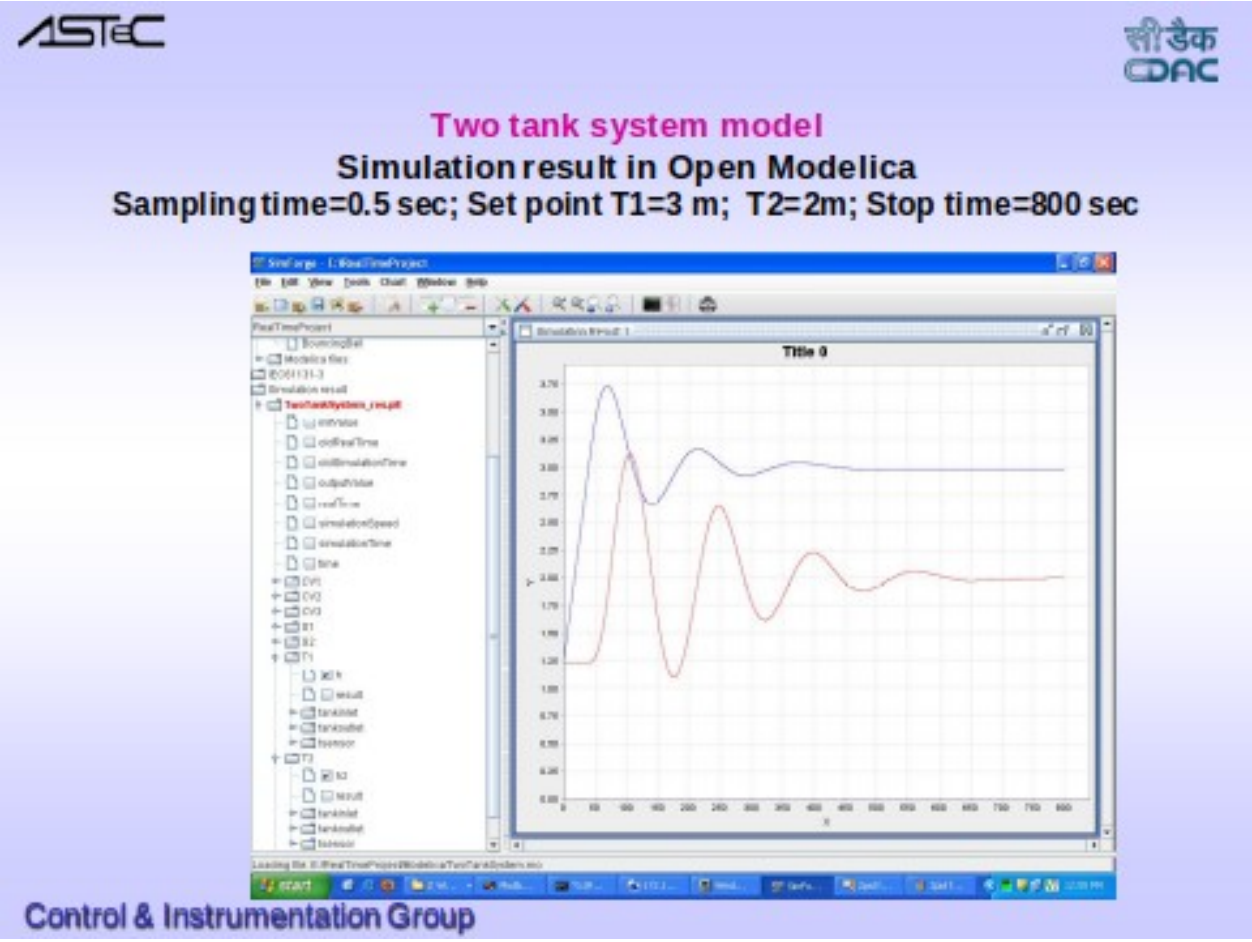




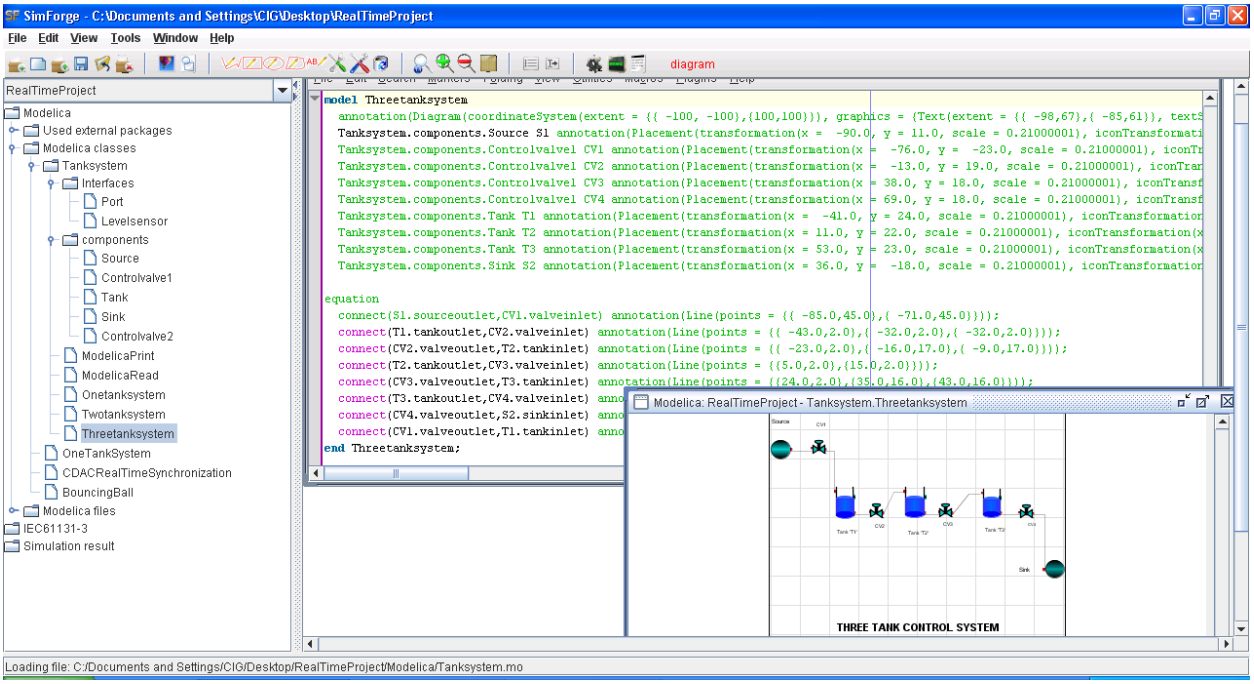
Two tank system model

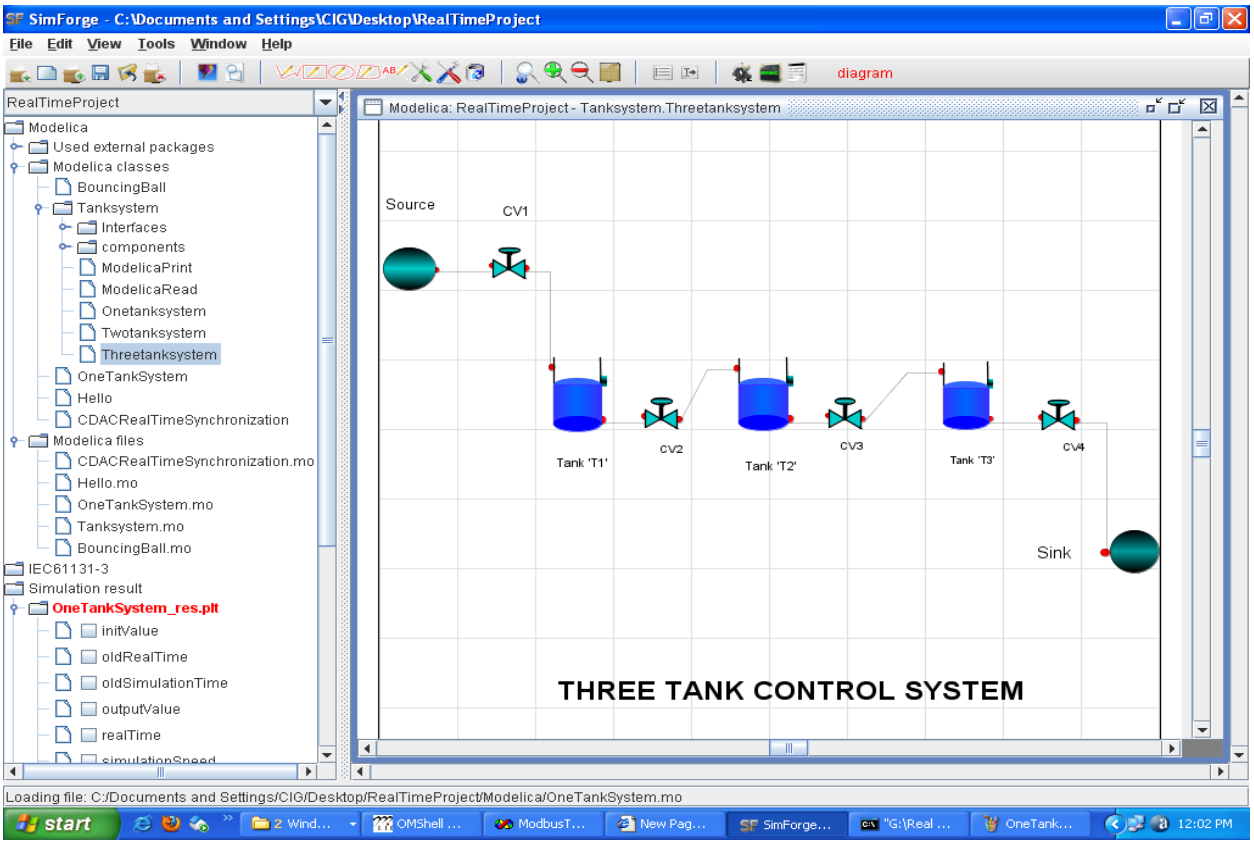
Simulation result in Open Modelica

Sampling time=0.5 sec; Set point T1=3 m; T2=2m; Stop time=800 sec



18. The three tank system is modeled in open modelica.

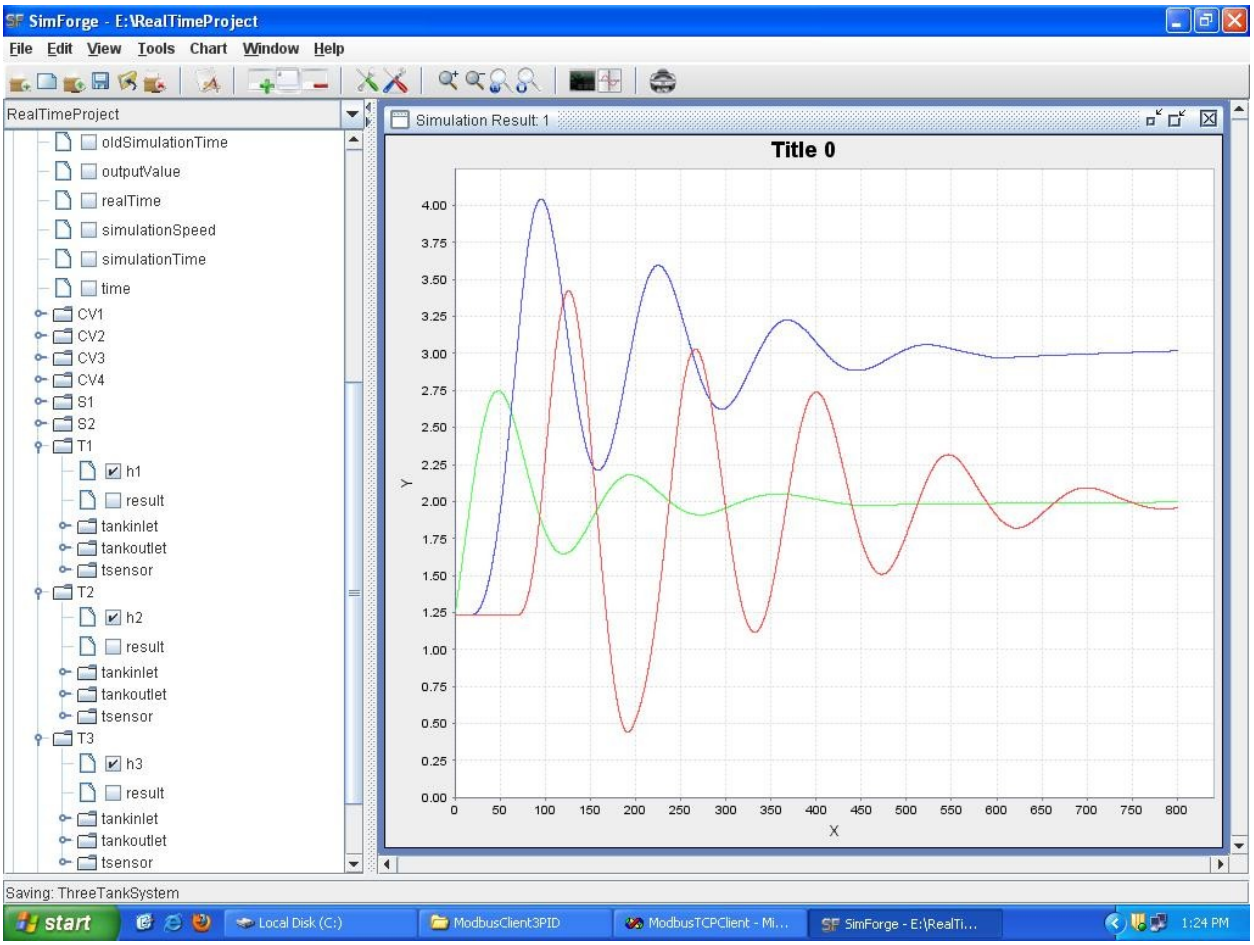




Three tank system model

Simulation result in Open Modelica

Sampling time=0.5 sec; Set point T1=2 m; T2=3 m; T3=2 m; Stop time=800 sec



19. The bouncing ball problem is tested for real time simulation.