Computer Integrated Manufacturing
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Lecture 45
Laboratory Demonstration Plant Simulation Software (part 1 of 3)

Good morning, welcome back to the course. I am Dr. Amandeep Singh, and I will take the Plant Simulation Tecnomatix in this lecture. So, we have discussed about the plant, we have discussed about the simulation.

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I will just like to give the contents here, the contents would follow like this first, I will discuss, what is PLM? PLM is Product Lifecycle Management, Product Lifecycle Management. Then, I will just go to my Plant Simulation Software, which is Plant Simulation 10, that is Tecnomatix. Then, we will just discuss the software, another software Arena is similar to this one. But, plant simulation or the PLM software that we have here, is in IIT, Kanpur that we have is, the Siemens PLM version, so this is the kind of very advanced version.

If we talk about the software, there are 2 major functions, one thing is a specification software one thing is the functionality, the functionality, what is the function that software is able to do? So, how intelligent is our software to design the systems? Second thing is the aesthetics, aesthetics or appearance. In this case, in the plant simulation software, I will show you that the 3-dimensional movements can also be seen, the aesthetics are splendid in this case. So, we can

see the workers taking the material, we can see the movement of the materials, all that animation kind of thing is there.

So, that is the kind of, I can this in add on but, the capability of this software to simulate using distance, different distributions using even we can have energy simulator to minimize the energy used in the plant or also we can actually calculate the throughput or the total output that is of a day or of a month, and in during the day or during the month, what is the cost that is incurred to cost of operating, the cost of processing, all those things can be done.

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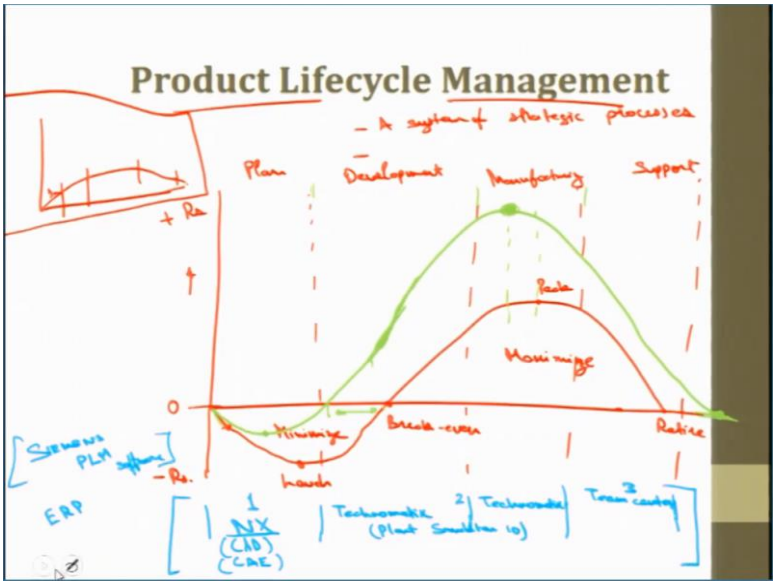

So, let me move forward. So, what is product lifecycle management? Product lifecycle management is the system of strategic processes which are employed to reduce the cost of getting a product to market. It is a system of strategic processes I would say. You know these days we need to extend the duration of the profitable years of the product, because the product if we talk about the product lifecycle, product lifecycle is something like this, not from marketing perspective I will talk up from the development perspective.

Product life cycle is if I say, this is my profit, so this is I would say, rupees and this is plus rupees and this is minus rupees. So, if I divided into stages when I am planning, and I am manufacturing, then I am building the product then, I am trying to provide after-sales support. So, this is not the marketing kind of product lifecycle that I am doing, marketing kind of product lifecycle is just like this, first, we have introduction, then we have growth, then we have maturity, then we have declined, and also some decay could happen. So, this is marketing perspective.

So, I am talking from the product developing perspective, from the when we design, when design a product, we are talking of the product design and the simulation in the systems. So, when we design the product during design itself, the development perspective is taken into account. Like in this kind of curve, which I am going to draw this is the curve like this, it was something like this.

Initially what happens, when we are planning, this is the planning stage, second is the manufacturing stage, then we have the manufacturing can be next step, then we have before manufacturing I will put manufacturing at third point, before manufacturing we have development, development of the complete plan or the development of the maybe prototype of the product.

So, after manufacturing, the product is sent to the market, then we have after-sales support. So, what happens, we need to minimize this and maximize this, this curve that is this my 0 value, that is below the 0 line, just this kind of a loss. So, this is I can say, this is here I can say the milestone, this is the launch of the product. I can have break-even point here because the investment that is made is covered here so, this is break-even. So, this is the peak profit that we have reached and the product retires here.

So, the lifecycle of the product of one specific segment in case of this electronics maybe mobile is about an year, or maybe it has even reduced, contacted then and year, it is about 6 months, 9 months sometimes. So, this is final retirement of a product happens. So, what if we use PLM, a product lifecycle management software, what happens is this is reduced, this is reduced and this maximized. You know this peak, a peak is I would better say, the peak is attained earlier than the normal design.

Then a product launch could happen even before, break-even is achieve before. So, this is a kind of a profit or the kind of a contraction in the time that happens using the software because when we are doing a simulation, you know it is better to fail a simulation than to fail a factory, it is a very a common quotes that is said. So, when we do simulation when we design the product, we can do the kind of testing.

So, if I am talking about the product, If we do planning here, the product will stance, if I need to design this mouse if I need to design this mouse, I would have, I need to have the specifications or I can just scan this mouse, and get the point cloud, and then the triangular mesh and those are the mechanical terms should get to do some analysis that whether, the

strength of the material, what kind of material would I use, all those things can be done in this software.

So, in that at simulation happen to that is a kind of mechanical simulation. So, we can even call at, if you have heard of the term computational fluid dynamics, that is a kind of mechanical simulation then, certain multiple modules are available for many software in the market. But, because we are talking more about the product design and manufacturing and we are not to talking about the systems' design here, so I will focus more on Tecnomatix, that is the manufacturing, the development or specifically the manufacturing part.

So, about this curve, this is here we have speed to market that it has reached the market before when productivities is boost you know the slope of this curve is higher, this curve the slope is higher, look at slope is greater. So, there is a boost in productivity, there is an increase in revenue because peak is here. Then we have the extended returns the retirement period is now, we get retirement at a latest stage.

So, this is what product lifecycle management, if we actually do the product lifecycle management, lifecycle means, not only designing the product, managing the overall the complete life of the product, from the very idea generation when we have an idea to produce a product to the final retirement of the product, retirement means when the product would just kind of obsolete a new product would takes its place.

So, about the software I would say, we have PLM Siemens software this is, we have these four stages. This part is done by NX, NX is a kind of CAD software, it is CAD and CAE, CAD is Computer-Aided Design, CAE is Computer-Aided Engineering, computer-aided design is been just designed like I said I will design this mouse, the specific product. I can, if I need to have the specifications, the specific curve I need to draw and I can design that is computer-aided design.

Then I can do certain analysis, certain testing on this, which are the critical part, and what will be the life of this plastic portion I am not talking more the internal body I am just talking about the curve of the mouse, that is computer-aided engineering. So, this is NX, NX software to use. We would more focus on the development and manufacturing that is done using Tecnomatix. Now, this is again Tecnomatix, this will use the plant simulation 10 software here. When we have designed a product and we know what are the processes which is this product has to follow.

For instance, this is the product they have different components, if I dismantle it this cover, this roller, the base, there are certain nuts, and this is a covered at bottom, the cell is here, the cell is an external component. So, I have different components which are to be manufactured. So, for this, I need to have plastic manufacturing machines like maybe, moulding machines or extrusion injection mould, injection moulding can happen all those things. Extrusion is not required like we need to have the machines. Now, how to set up those machines in plant or in a factory that is known as plant layout that I will also discuss here.

So, this is Tecnomatix and the final support that is done by team center, this software has major 3 version number one is NX, number 2 is Tecnomatix, and number 3 is Teamcenter. This complete version we can call it as an ERP, and Enterprise Resource Planning. So, this enterprise resource planning team center is more focused on ERP but yes, we can say that enterprise, complete enterprise resource planning can happen and we can even simulate. The simulation happens more in NX and Tecnomatix.

And in team sector what happens, whatever, we have manufactured the cost which are incurred for manufacturing, and if we need to change something because you know this is planning and the planning, and the actual production there is a difference when that difference happens during actual manufacturing when we actually doing the manufacturing the data is all stored in our different formats.

Those are used by the team centre version of the software. The data is stored in different formats. So, that can be used though formats, which are available in team centre and team centre, we can just modify the data according to the actual which is happening, though not schedule the actual manufacturing.

So, then the simulation can be run again, sometimes like to see whether what we have plan are we feeling that or not? So what are the variations? You know some variation always be there. And those things, it has an extensive application. Arena is a kind of a software which was just confined to the plant simulation, plant simulation only but, this PLM Siemens PLM, I am talking about Siemens PLM, PLM software. So, this can work in all these domains.

Now, I move to the software which is a Siemens PLM software, which is in the SSOL lab, SSOL is Smart Systems and Operations Lab, which is here in IME department, Industrial and Management Engineering Department, at IIT Kanpur. So, the software is installed in the

systems in the lab only we have server in the lab only, we cannot have the software this. But I am using the software using remote access on this computer.

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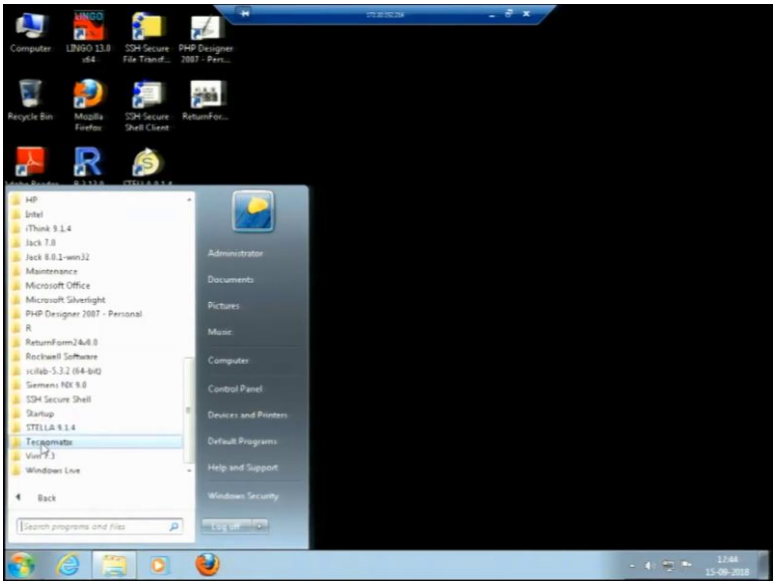

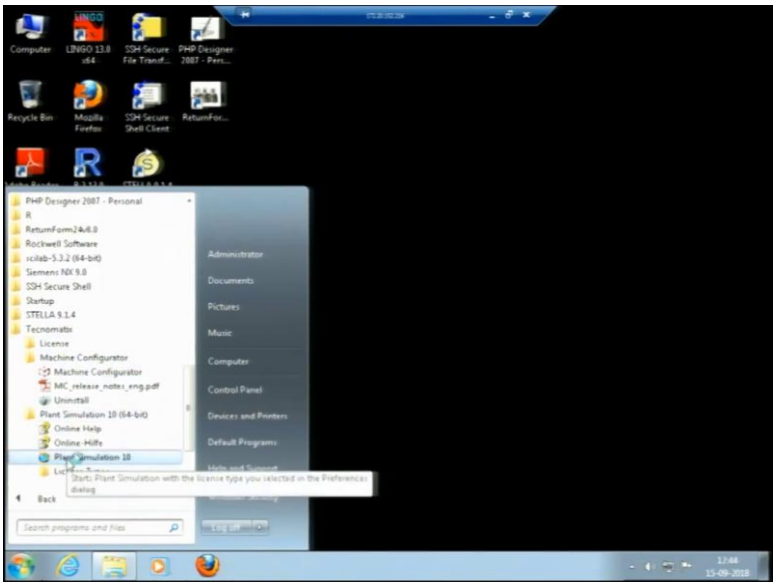

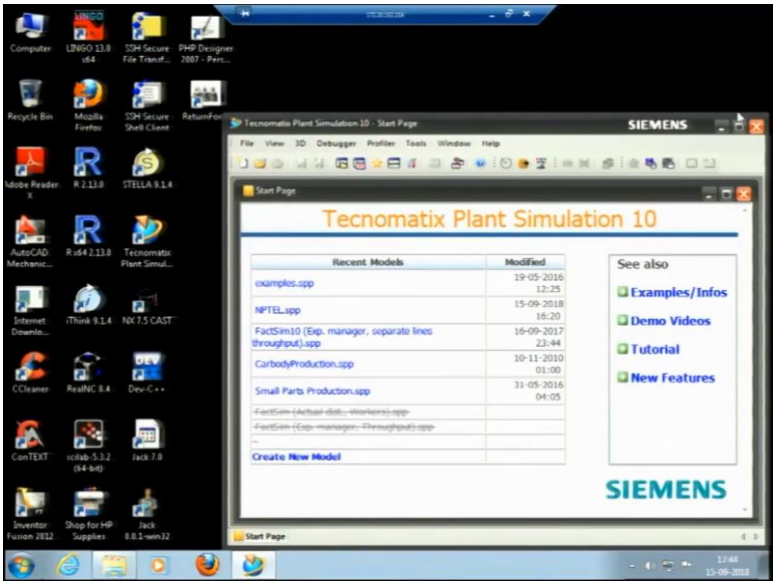

So, I will just open. So, remote access connection is already made so, this is my computer which is there in the lab, and I will open my software, I will go to all programs and I have Tecnomatix here and in Tecnomatix, I have plant simulation and I will open the software.

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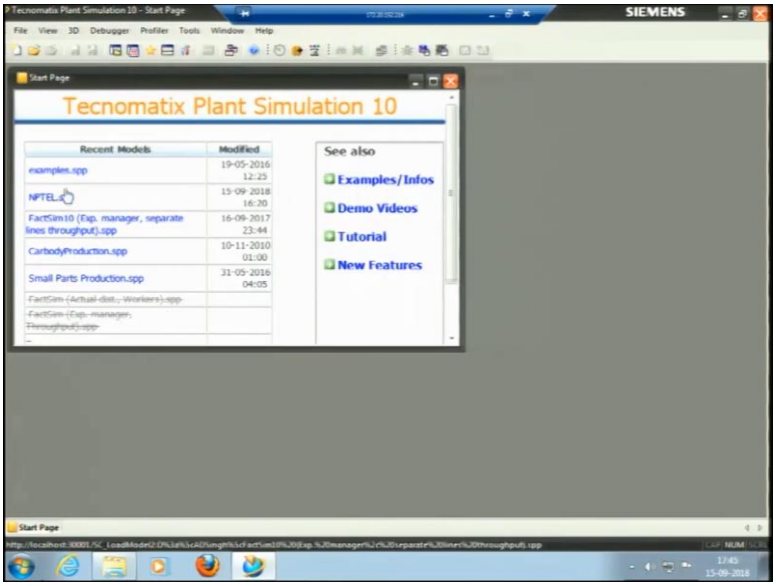

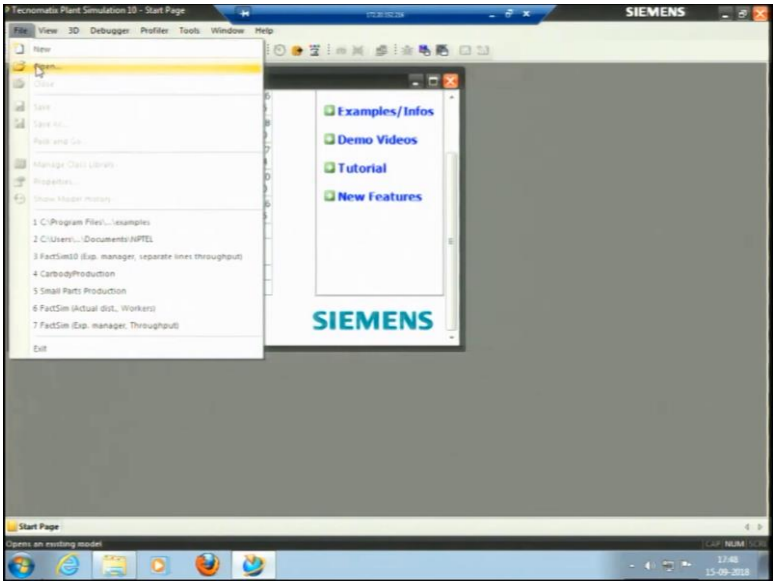

So, this kind of window appears, when we just open the software these are certain programs in which I have just worked on so, the recent programs are there so, this is a start page.

So, I can open or I can create new models from here so, I have menu bar here, in menu bar also I can open the new file I can open the existing file that we have so, in also we have another this tab here, we have these icons for opening so, I will just create a new model when I click the new model, the new model is trying to open, yes.

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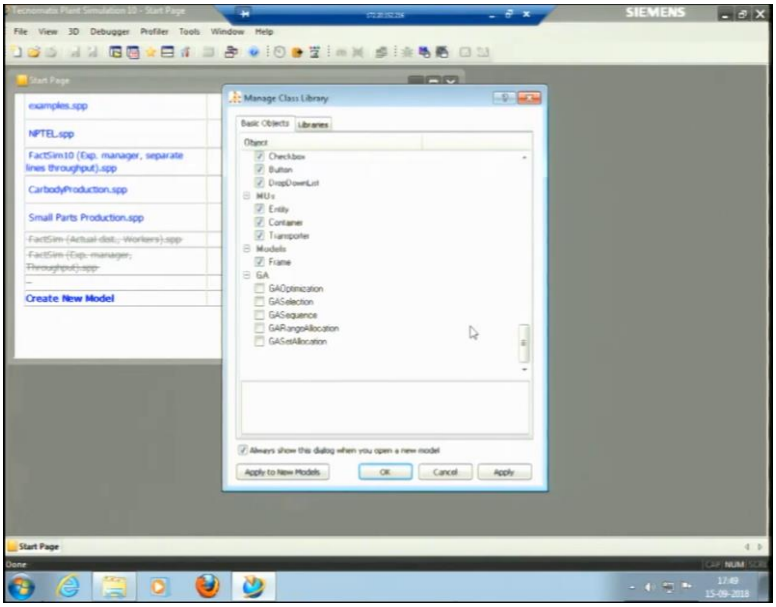

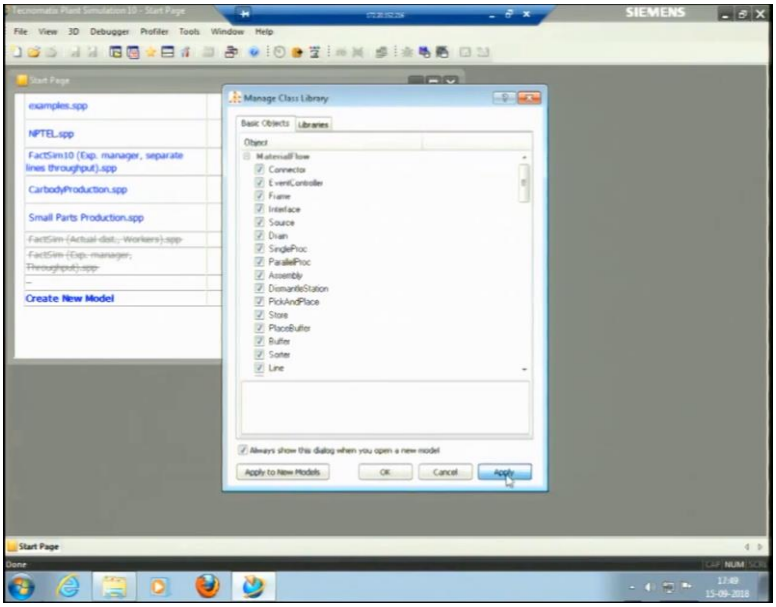

Now, it has basic objects here, the basic objects which are there, these would be enough to discuss in this lecture, we have a limited scope and time here so, basic object whatever, I have selected I will just say yes to them, however, there are multiple models that we can select here as we can select certain to this big library and I can select the 3D or you know this is AGVS automatic guided vehicles then, 3-dimensional conveyor 3 dimension robots conveyors all those things. But I will stick to the basic selection whatever, it is default selection apply.

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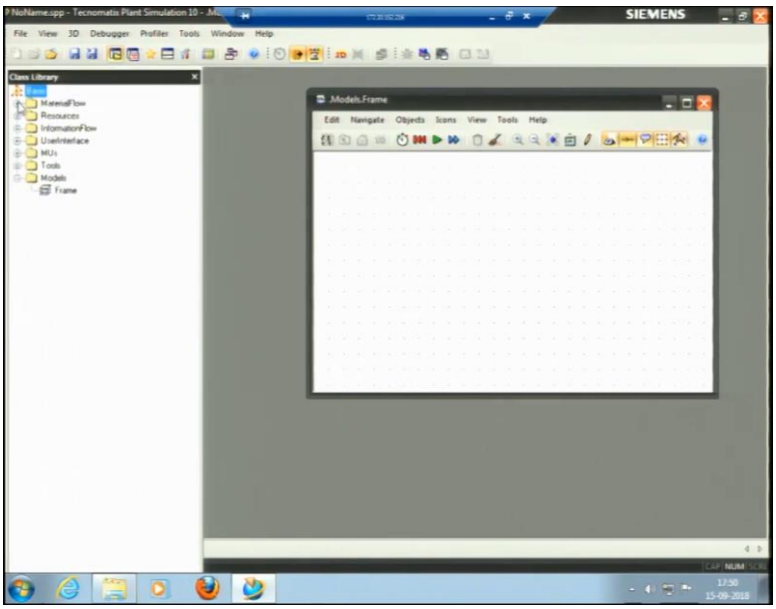

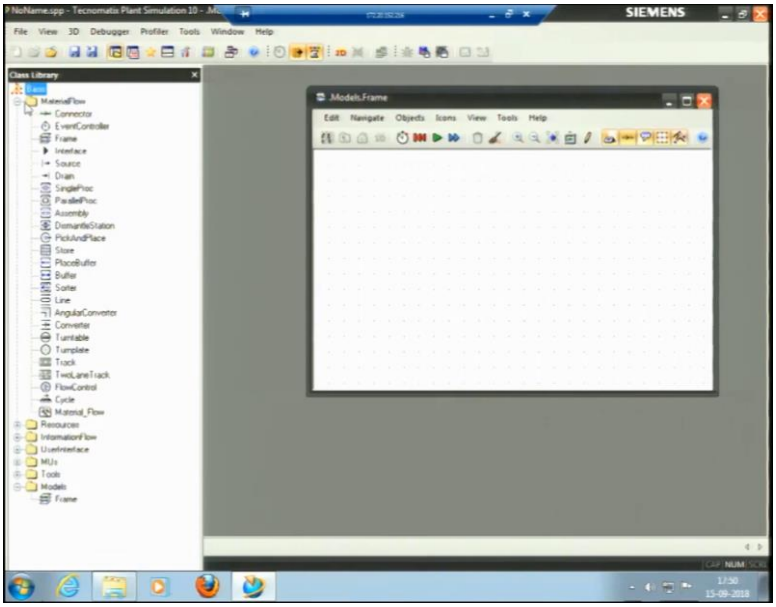

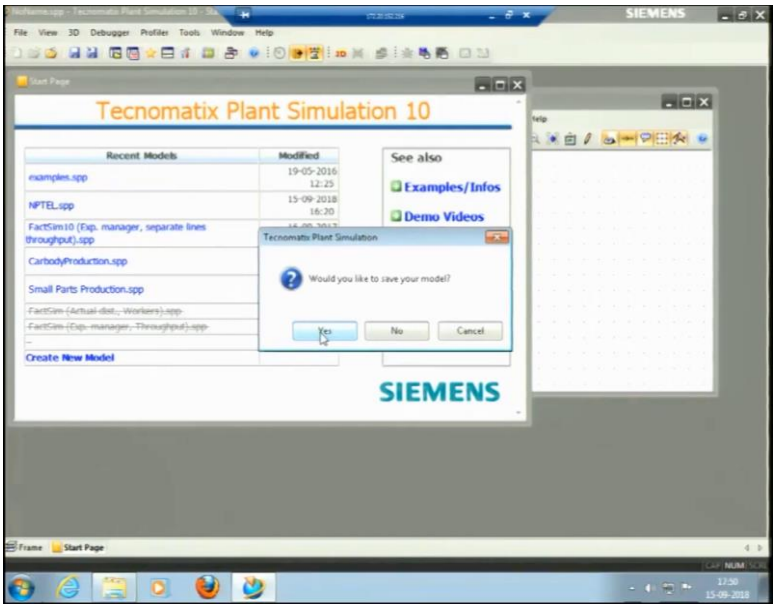

So, the model is open so, this is the model frame, this is workspace we will work, and there is a grid the distance between any 2 points here the horizontal or vertical distance is 1 metre I can just switch off and on the grid from this icon, this button here, it hides or shows the grid so, these variations I will show later.

So, this is my class library I am just clicking it to bring my icons here so, these are the components before actually starting the model I would like to show you what is the, we would say the potential of the software so, I have one example here.

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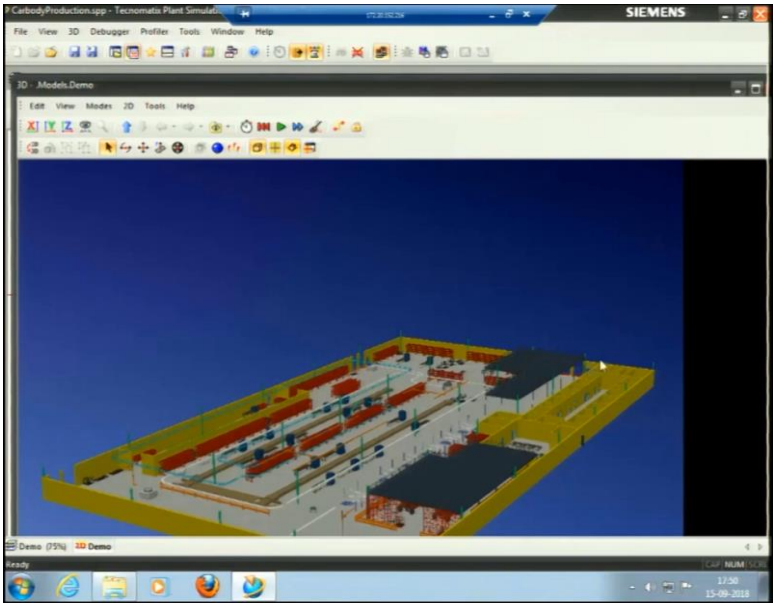

This is the car body manufacturing in 3-dimensional, car body manufacturing. So, this is an example in which whole factory is build in the software, and also the general motors had built one of his new plants using this software and they have reported that fifty percent of the savings were there in the developing part because they developed they try to simulate the movement of the objects and the times and all those things, and what actually they were trying to do in manufacturing there are able to see that in the software like, animation.

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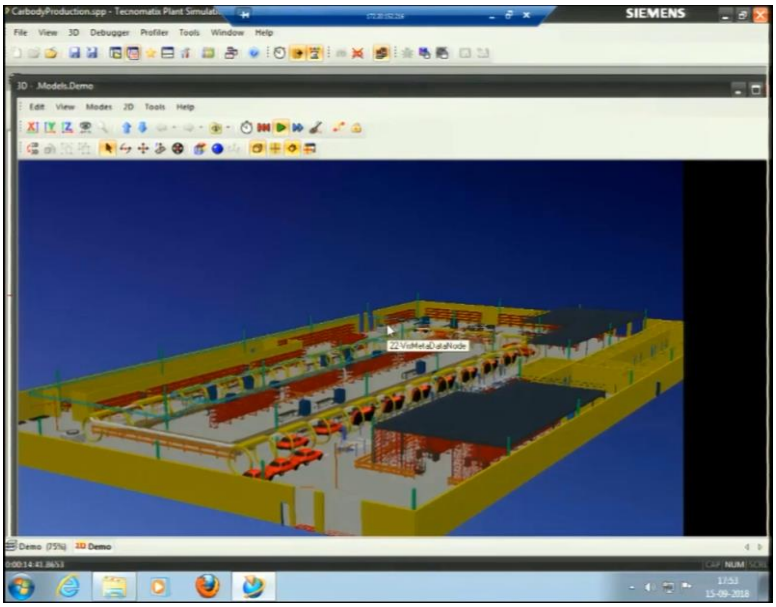

So, this is my remote controller so, I like to show you how the manufacturing happens. You know this is you can see this is actually moving very fast like, control the speed you know

workers are moving in very fast speed if it is the fastest speed so, I can control the speed using even controller speaking let me stop it and let me say the speed real into maybe five times or maybe real-time into ten times, apply ok then play.

You know the car is coming here, it is taken by the overhung conveyor. So, the workers are standing here, you can see workers are doing trying to fix maybe tyres or the wheels here, or the side mirror. So, the car is completing manufacture and the accessories are just put at the cars and those have been sent; so, these different workers those are working in stations this is the workplace I will just show you the objects when I will come to the actual practice on the software this is the workplace, work pool were the workers could stand when there are not working, and this is the workplace for the workers, and worker just speaking it from some point purple pillars that you can see, these are, this purple pillar and this purple pillar.

So, these are the workstations for the worker, actually this space at the bottom this is a workplace where the workers working and some other processing is also happening so, cars are just this is an entry point, this is my entry point and here it is taking turn and this is the exit point so, this is the factory, I can show you some other examples.

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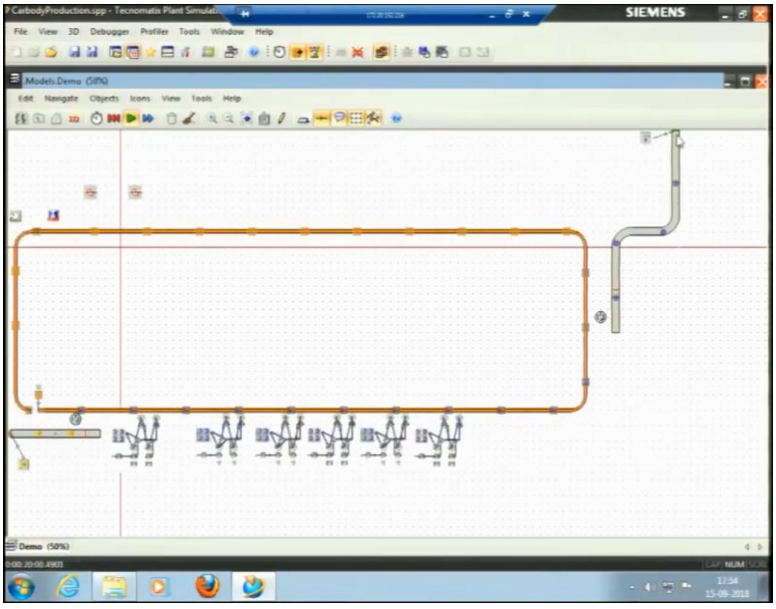

So, this is the 2-dimensional version of that putting the workers are working here, you can see, so, the car is going out and for some other part but, maybe inspection it is so, close this model.

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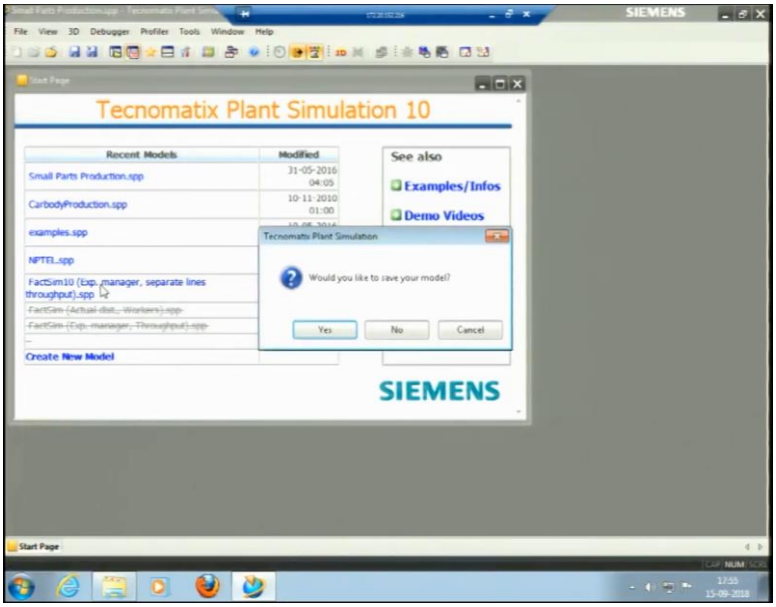

And, I will come to my start page again, and view from view come to start page. So, this is how we can see or I can just pick let me open this model.

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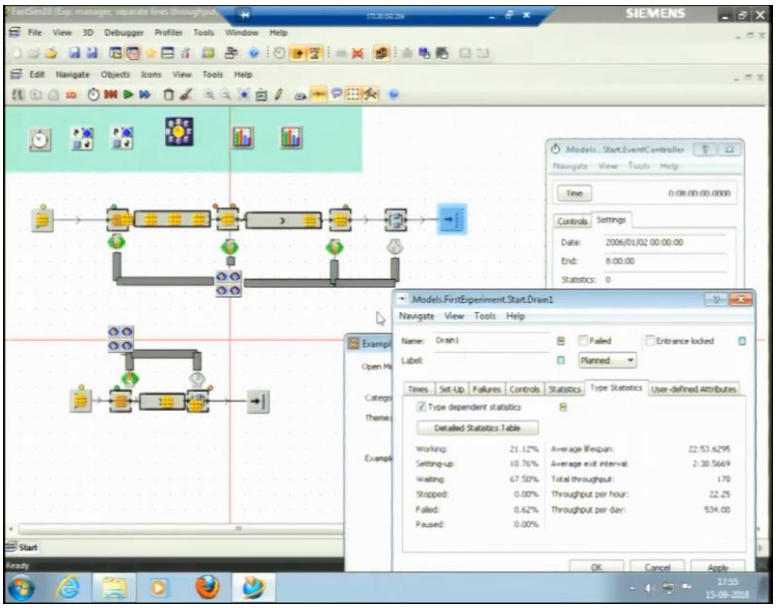

This is one of the models, in which we have used the experiment controller, so, you can see if I run the model it has run for 8 hours, from the fastest position it has run because I have put the end time for 8 hours models has to run and I can see the throughput here, open, it is the drain, the final drain, I can see the throughput here, what is the throughput? What is the total number of components? you have to though, that in fact is throughput per day if you see here this throughput per day 534 pieces and throughput per hour is to be 22.5 pieces.

Based upon the input we have given to the specific processes, whatever, the input to the processes that we will discuss it is the setup time, processing time than, the availability is it available for the complete time, or is it available for 95 percent or 90 percent of times. Then, we have a distribution, we have a specific process, for instance, it is a manual process and we do not have much data we have only 2-3 data points which are previously available so, we can pick maybe triangular distribution, if it is an automatic process I can pick a normal distribution with a very less variation because the process is automated based upon the inputs that we give, the software will try to simulate and give us a throughput.

So, any software when, we say the software is here, that is a very common quote that is said it is GIGO, garbage in garbage out; softwares can just help us to bring our overall ideas into one place, and we can simulate the computation that we sometimes try to do on-page those can be done here, and the software's are able to show the animations in a very elegant way. But if the input is not proper input has to has to come from the systems manager or from the person, who is trying to work on it so, if the input is not proper, output would obviously be affected the more errors would come.

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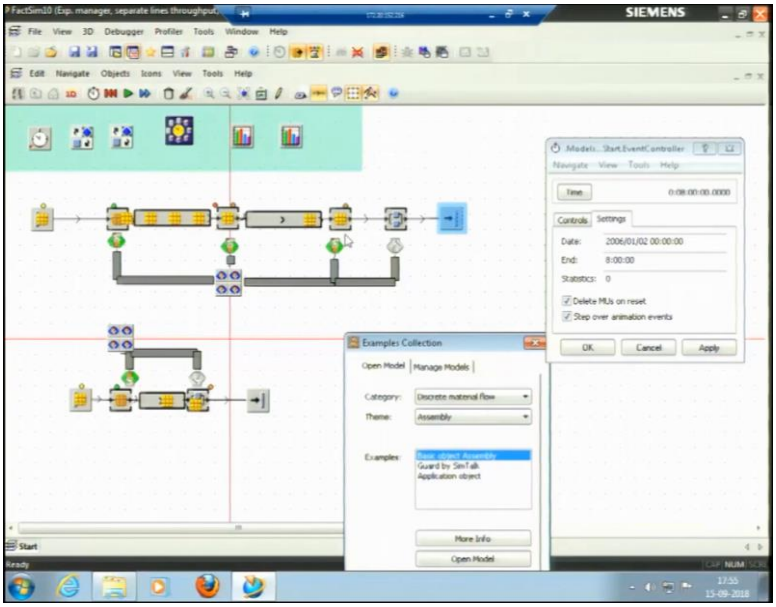

So, this is I just showed you how to see the throughput so, let me close this one as well and try to make a model for you, you people and I will let you know how the model is made so, I will like to stop here and thank you for being in the course so, we will meet next time. Thank you.