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**Lecture - 59**

**VR roadmap**

So, welcome to this lecture of Industrial Safety and Engineering in which we will see how the virtual reality techniques, we can implement in a in our particular domain in safety domain or different domains in which you are working. So, the particular lecture will be termed as VR road map. The road map to create the virtual reality environment how to create how to know this virtual reality techniques.

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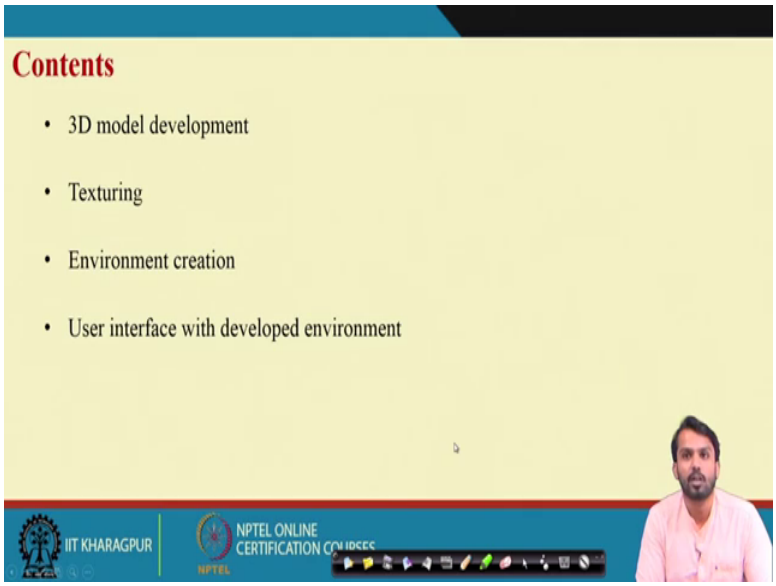


So, the contents will be 3D model development, then texturing environment creation and user interface with the developed environment.

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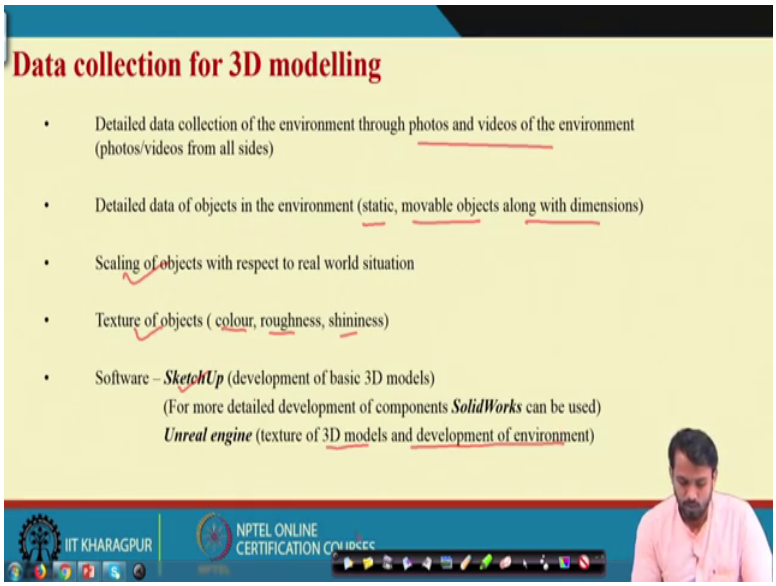


So, for that first what we have to know the data collection that is required for the 3D modelling. If you are going to develop an particular 3D modelling of any particular component that is present in your workplace or present in any scenarios accident scenario or real scenario, then you should be knowing what are the detailed data required for creation of the particular 3D models.

So, for that particular purpose we are we should know what are the data collection procedure or what are the data collection methods that are used for the 3D modelling purpose. So, detailed data collection of the environment through photos and videos of the environment, then detailed data of the objects in the environment static movable objects along with their dimensions which is very much important for the creation of a virtual environment for the placing of a object in the virtual environment.

Then scaling of object with respect to the real world situation through scaling why the scaling part is important because, whenever the user will be interacting with the components in inside this virtual environment, you should be feeling like this object is present in the virtual environment. The object present in the virtual environment is the replica of the object present in the real world. So, there should be there should not be any mismatch between the dimension or the aspect ratio of that particular component that is present in the virtual environment.

For that purpose scaling of the object is very much important, then texture of the object; the texture of the object means the colour roughness and shininess. If you are placing an object in the virtual environment which is already present in the real environment; so, the object or component should look like the real environment. So, that the user should not feel the difference between the component of real environment and the components present in the virtual environment.

He should as for that he we can work smoothly and performance stand in standard operating procedure which we usually perform in the real world. So, what are the software that can be used for the purpose of this 3D modelling and texturing? So, for the purpose of 3D development of 3D models SketchUp software can be used along with Solid Works and 3D S Max, Maya software also it can be use it can be used.

Then unreal engine is used for the texturing of 3D models and development of virtual environment. So, apart from the photos and videos that can be captured for the modelling captured as the data source for the 3D modelling, what we now it is what we can do is we can have one 3D laser scanner that is a very advanced equipment which is used for the purpose of collection of data in a complicated shapes or complicated complex environment.

So, if you are going to take the data of a complicated devices or complicated equipment or that is placed in a complex or integrated workplace; so, what you have to do? You just place this 3D laser scanner in that particular workplace and it will automatically scan the workplace by rotating 360 degree and it will give you the output in the form of a point clouds. So, you just have to join the point clouds using requisite softwares and directly you can create the 3D models.

So, in this process, what will happen is the time required for the photo photos and videos collection and time required for the generation of 3D models in a using solid different 3D modelling software can be reduced. Directly you can create the 3D models with the help of this joining this point clouds.

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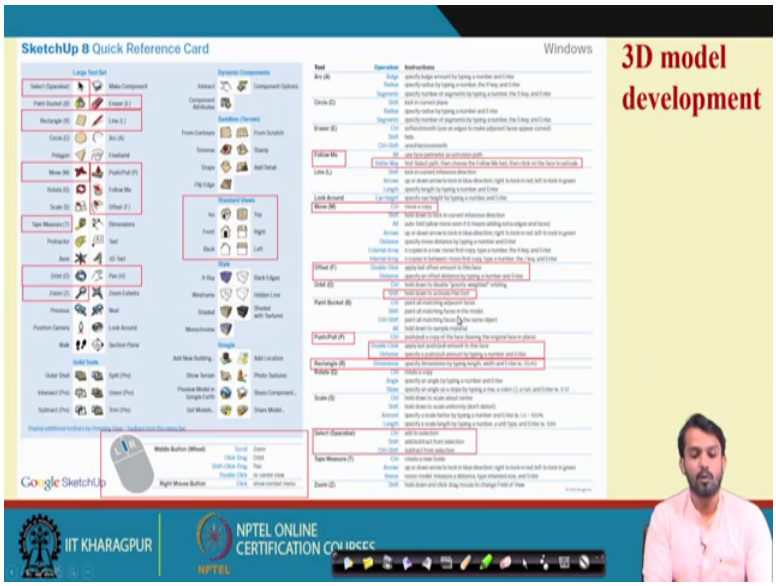


Next I am showing you one reference snapshot of the software tool that can be used that is Google SketchUp in which different kinds of tool sets are given here like select rectangles, then polygons circle, tap maiser orbit zoom.

So, this kind of different dynamic components and different last tools that are available in which certain tools are also there in which you can perform your operation very easily like follow me. It is it can be executed by selecting the path, then choosing the follow me tool it will automatically guide you to what you want to develop in this, but with the help of this 3D modelling. Then move command you can use, then offset command you can use to create a distance between the offset distance between the two objects.

Then push and pull operation which you can use for the; that means, width generation, then rectangle are the basic tools that are used to create a 3D models then select bar are also there. So, you just have to what you have to do is you just install this software Google SketchUp software, then go through different tools and tools available on that Google SketchUp software and just explore through this tools and techniques. So, that you can easily know what are the ways the 3D models can be created.

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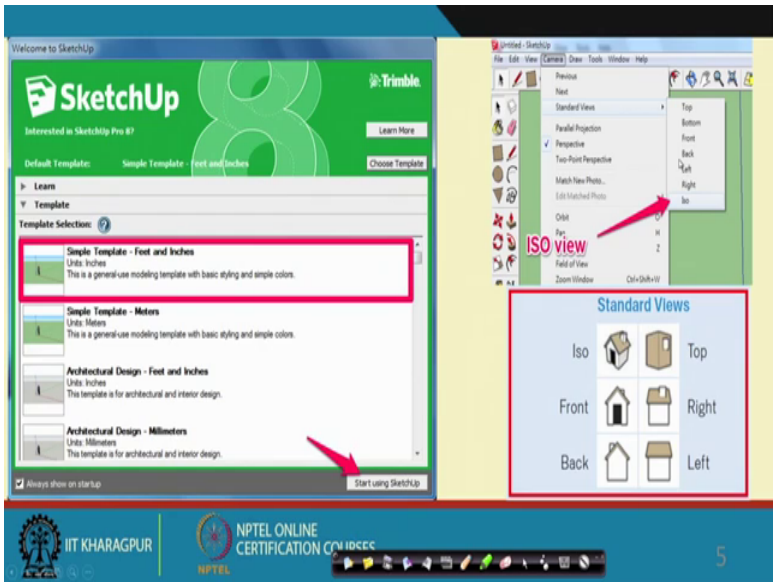


Like first the simplest template is the feet and inches in which the dimension can be you can given when you can give or by the dimension in terms of metres you want to extract. So, this is the simplest template you can use and standard views which kind of view you want either you want top view, bottom view, front view, back view or ISO view that is isometric view. So, you can see different kinds of views also in the SketchUp software. So, this is another snapshot of this SketchUp tool how we are using different kinds of views.

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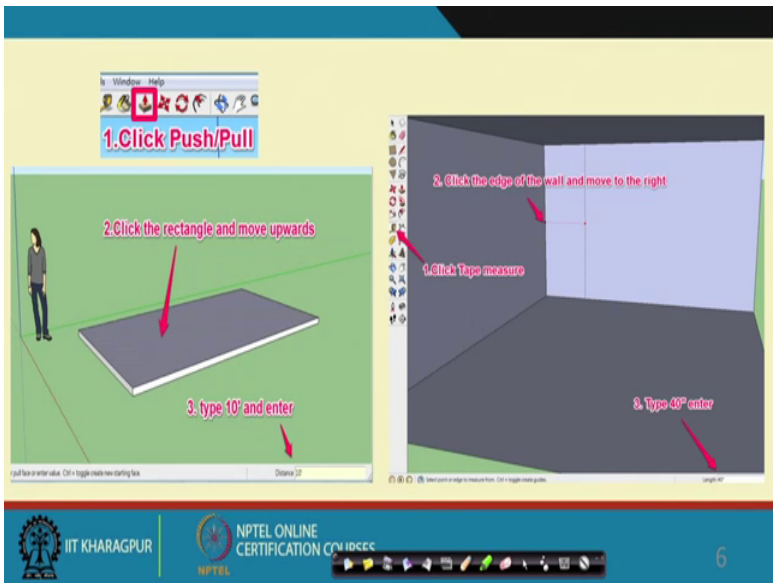

Then by how to create a normal 3D model? So, you just click the rectangle click the rectangle and create a rectangle here, then click the on the tool push and pull and click on the particular rectangle and drag it. Simply you can create a 3D model of the rectangle. So, click the edge of the wall and move to the right click the tape measure for the dimension in purpose and enter whatever dimension you want to insert in that particular whatever dimension you want to give to the particular 3D model in one of the edges or one of the sides.

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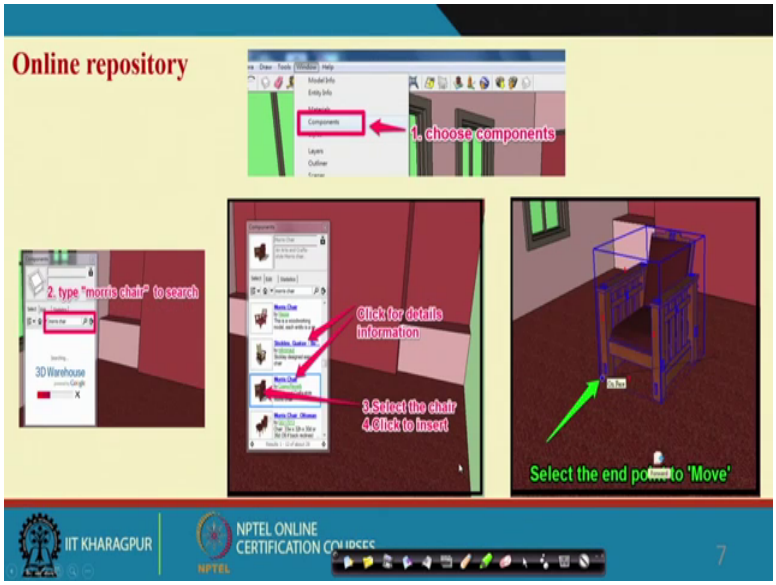


Next if you are not able to create any 3D models complicated 3D models or 3D models having dimension, you can also use it is online repository in which you can search if you want to search chair Morris chair, it will come automatically. If you want to this use this Morris chair also. You can directly drag and drop this 3D model inside this inside your software 3D modelling SolidWork software and later on you can add some dimension or add any modification you want to add in this particular 3D model, you can also give along with dimension change.

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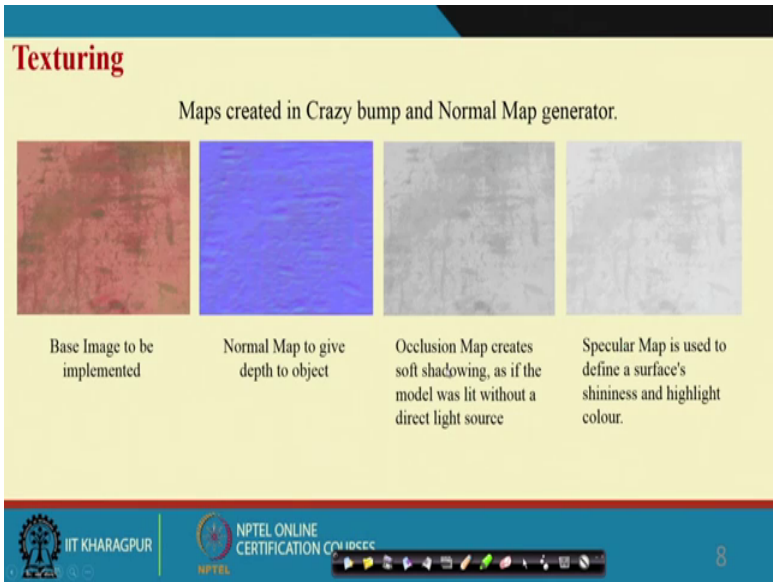


Now, the texturing part so, that for the texturing four kinds of thing, we have to look at first the base image to be implemented. Suppose you are you want to develop the texturing for a particular component; that means, you have to take the pictures of the component present in the environment means real world environment, then a base image of that is that component is to be implemented, then normal map. So, this normal map will give the give depth to this particular object.

Then the occlusion map it creates the soft shadowing as if the model was lit without a direct light source; that means, occlusion map will create the soft shadowing. Then the specular map which is actually used to give surface shininess and highlight the colour of the particular component. So, this maps can be created in crazy bump and normal map generator also; otherwise you can directly create this in your unreal engine this is also used for the texturing purpose.

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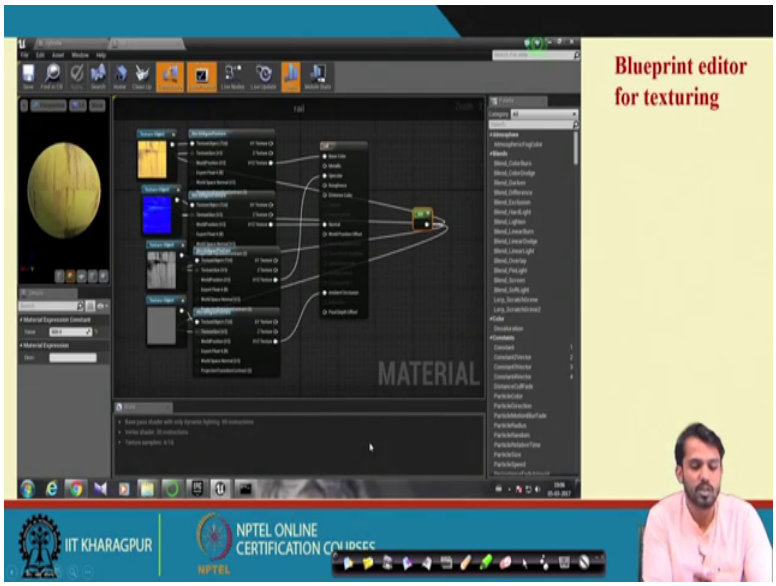


You can see how the how we created a particular how we have taken the snapshot of a unreal engine platform in which we created this texturing of a object, we can see four types of normal mapping; normal mapping and along with occlusion mapping, normal mapping occlusion mapping and base images are implemented here and it is connected through a event graph. So, whatever texture you want to give to the particular object it can be created to the object is placed here; that means, reel we have created on texture for every reel

So, object is placed here so, whatever with the base colour whatever will be the specular mapping then you are normal mapping and occlusion mapping. These kinds of mapping you can directly create and connect with the help of this event graph. So, this is actually a view of how the texturing is performed in a in the unreal engine software with the help of this blueprint editor. So, you can see this tutorials for this unreal engine softwares which we used for the purpose of creation of this virtual environment in a workplace.

And this there are some plenty of videos tutorial videos for this unreal engine software you which you can search and see how this they are doing the texturing how they are inputting the 3D models inside, the unreal engine software how they are placing the different 3D models inside the software and how they are doing the soft shadowing, how the light and camera position is taken care of inside this unreal engine software.

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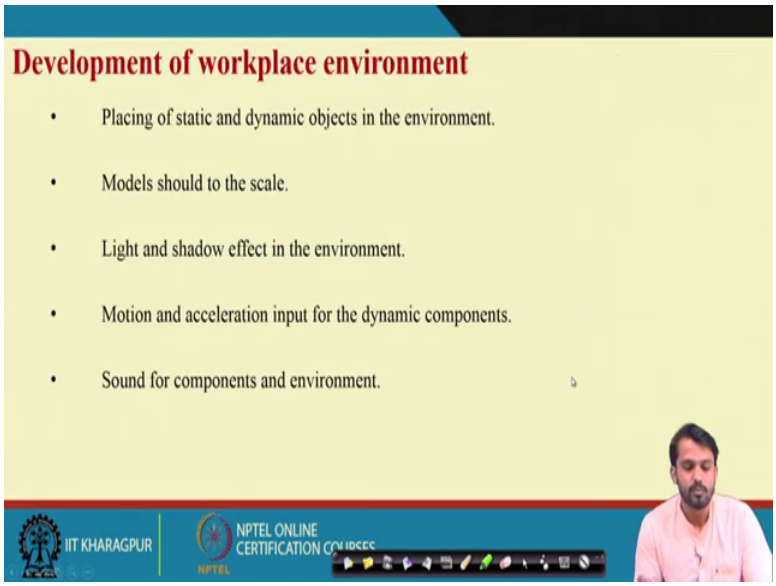


Then development of workplace environment: so, how the complete workplace environment will be developed? First as we see as we already discussed that we have to take the pictures and videos of static and dynamic components these are present in the workplace. So, first you take the snapshot and videos of the static and dynamic components, then you take the data of the acceleration or motion inputs and acceleration data or velocity data of those dynamic objects and how to place those objects in the environment that is to be taken care of.

By take by obtaining the layout of the workplace, you can have this you can achieve this placing of static and dynamic object in the environment. Then model should be properly scaled light and shadow effect in that particular environment should be taken care off. Then motion and acceleration input for the dynamic component which is which is very important like the vehicles or the crane movements inside the environment. So, these are this the dynaming of components need some motion and acceleration input which are you have to take care.

Then sound for the components have and the environment sound for the components of the environment also taken care of because sound is very much needed because the user if the user will be interacting with the virtual environment. So, whatever sound different kinds of sound he is experiencing the in the real environment; so, he should experience

these kinds of sounds in the virtual environment also. So, that he will feel the immersiveness inside the virtual environment.

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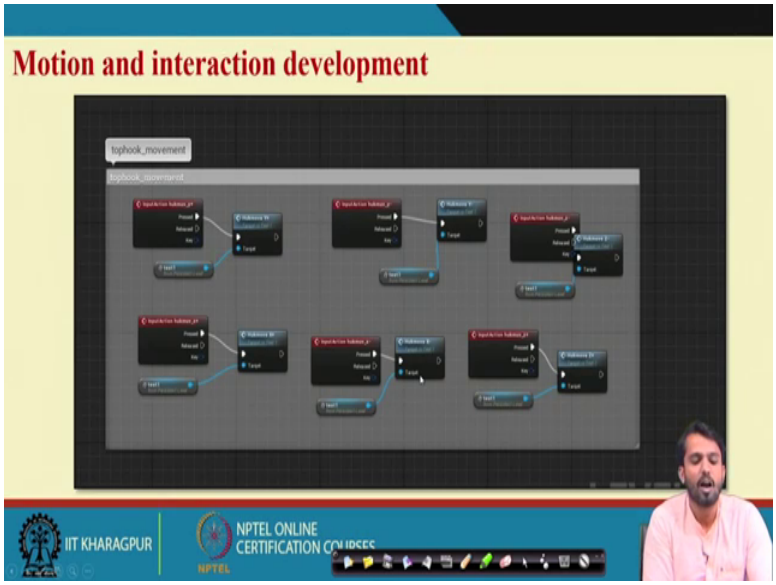


Then how the motion and interaction is developed? So, we have done for a hook movement, I am showing you an snapshot. So, in y axis you have to give input, x axis you have to give the input, then y z axis also you have to give the input. So, hook movements and different input action for the particular component has to be given with the help of this unreal engine softwares. So, this is the snapshot how we develop the movement of this why we gave the motion and interaction to a particular component by using the event graph.

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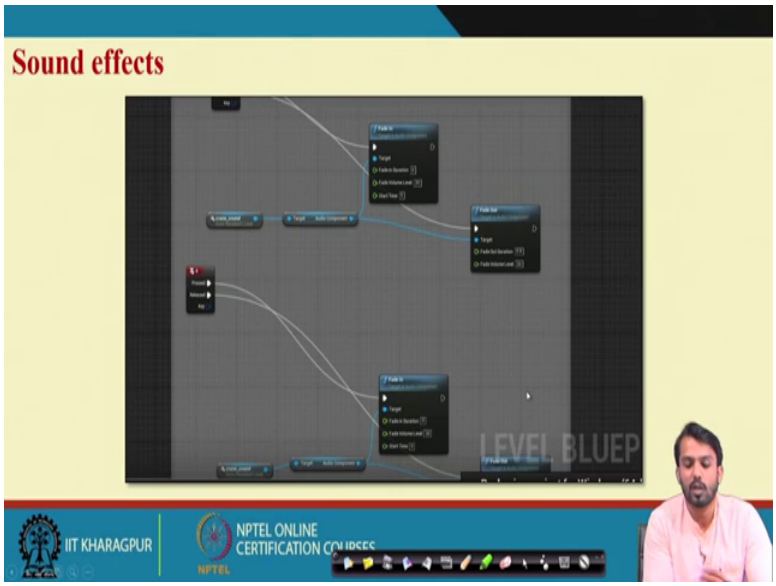


Then similarly sound effects also can be created then; that means fade in there is a property called fade in how much time the sound will fade and how much time the sound will fade out. So, by different input by pressing which key the sound will come or automatically the sound will be continuing in this particular environment so, crane sound you can input. So, we perform the we develop for the crane simulator we developed. So, in which crane sound is given and to the target component audio component so, you can modify as per your requirement.

So, up to what extent the sound will generate of or you want to merge different kinds of sound inside the workplace in which different kinds of components produce different kinds of sound. So, there is a option also property also where you can merge the different kinds of sound and there should be no interference between the sound creation. So, thank you, in this way we can see how we can develop this virtual environment and how we can handle different properties of virtual environment. So, what you have to learn is first the modelling of different components, 3D modelling of different compounds which can be done with the help of requisite softwares.

That means 3D modelling software's which for the purpose of which you can use Solid Works, then your Google SketchUp, then 3D S Max or Maya, then apart from that is after you developed this 3D modelling. Then you will go for the texturing of those 3D models to give the real look; to give real look to the 3D models which will be present in

the virtual environment. You can use different types of software on real engine and for the creation of different kinds of maps which I already explained normal mapping and occlusion mapping. Then base image implementation you can use crazy bumb software also for the creation or you can directly create those in textures in the unreal engine software. And finally, how to import those objects to the environment you want to create workplace environment you want to create and placing those objects in the environment as per the requirement scaling those objects in the environment as per the requirement. So, that the user can feel the presence of those components; as if they are present in the real environment.

The lights shadows and camera position of the camera position should be taken care off in the virtual environment also so, that the propagation of user interactions would be proper. Along with that the user can interact with the virtual environment with the help of different input devices which I already explained in the 1st lecture. So, the in with the help of this HMD Head Mounted Devices, you can interact with the creative virtual environment and perform your standard operating procedure with the help of different input devices either it will be through a gamepad oculus gamepad controllers or it can be with the help of this keyboards or different kinds of joystick winds.

You can use these kinds of devices and apart from that whether the operator is performing the operation correctly or not, the data can be captured with the help of sensors. Those are mounted in the lab environment in which you can capture the users movement data and with the after that you can analyse those data and different kinds of error in the movement or whatever the activities they are performing correctly are wrongly you can measure also and you can later on you can suggest for the necessary prevention strategies. You can you can propose those that these are the ways these activities would have been performed.

So, this kind of analysis is very much possible by creating a virtual environment. So, you think accordingly how you can develop a virtual environment for your workplace in which you are working and what are the standard operating procedure you are following in the workplace. So, that you just have to capture the those data and create the 3D models, then incorporate the 3D models in the um requisite software for development of virtual environment.

Then perform give training to the new operators or training to the experienced operators and create different kinds of accident scenarios or hazardous elements hazardous elements hazardous environment also you can create for which you can later on give training to the new operators how to avoid those hazardous circumstances and perform safely the different kinds of operations.

Thank you.