Introduction to Industry 4.0 and Industrial Internet of Things
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Lecture – 64
Virtual Reality Lab

I am now going to take you through one of the state of the art facilities in Virtual Reality in the country and there this particular lab the virtual reality lab was developed in the department of industrial and systems engineering at IIT Kharagpur, under the primary leadership of directors and professor J Maiti of the industrial and systems engineering department and along with him there were different other faculty members including myself together we have developed this particular lab.

So, I now request professor J Maiti who is currently the head of industrial and systems engineering department and also the principal developer of this particular lab to say a few words describing this lab.

Thank you Professor Mishra, this laboratory is a part of safety analytics and virtual reality laboratory it was established in the year 2016 under the mentorship of Professor Partho Prathim Chakraborty our director, it was conceived a primarily for accident research and virtual prototyping including simulation.

As accident cannot be created or experimented in industry, so our ultimate aim was that whether we should have some kind of facility where we can develop the industrial system and also create the different kind of accidents. And it is equipped with high end computing, projection system, immersive system, tracking a navigation system apart from this laboratory is having other accessories or supporting equipment and it has lot of application in particularly in the area of industrial IoT and we can go through this particular facility thank you.

Thank you Professor Maiti. Let me first introduce to you Mr. Kranti who is currently the phD student in the department of industrial and systems engineering at IIT Kharagpur under the supervision of professor J Maiti. And let me just ask you Kranti could you please explain about the infrastructure of this particular lab, particularly the main components that we have over here.

Yes, sure so we are having different kinds of tracking and head mounted display kind of equipments which basically used for the virtual reality experiments.

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So, we are having different kinds of data gloves. So, these are the data gloves which are used to track all the, used to capture all the motions related to your finger. So, this particular data gloves is having 14 sensors, so it will capture all the finger motions and different wrist motions related to whatever user movement will do; similar.

What kind of sensors are there?

Sir piezoelectric sensors, these are piezoelectric sensors.

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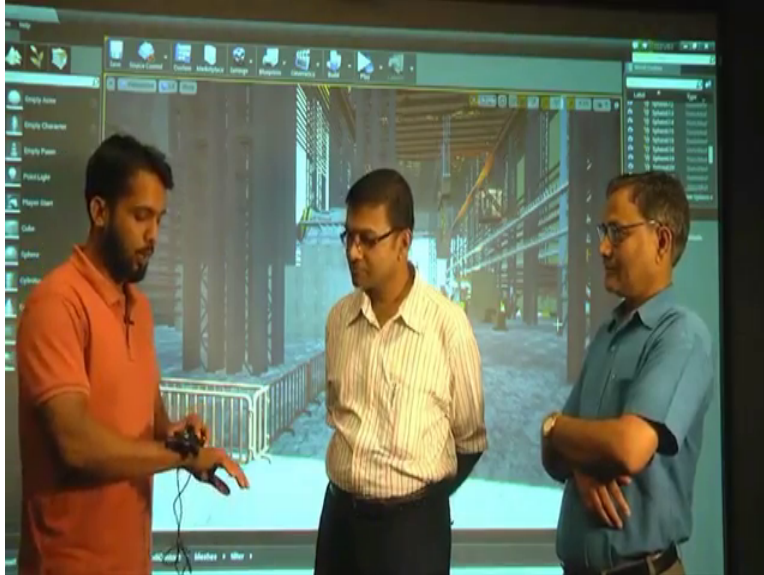
Similarly we are having this hand tracker, so you just had to mount this hand; hand tracker on your wrist so that whenever you will move certain object or whenever you will capture and move certain object you it can capture what with what force you are capturing that object. Similarly what is your pitch roll this kind of motion also this will capture.

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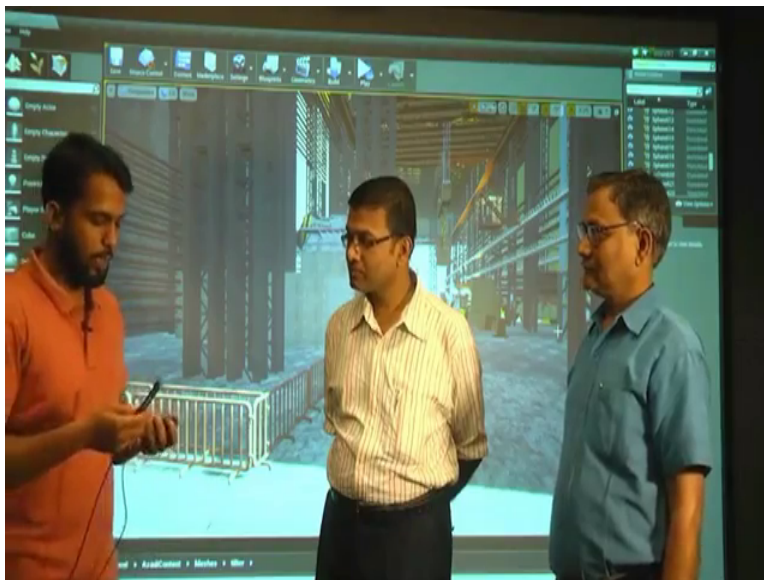
Apart from that we are having a particular head tracker, so what it will do is I will show you how to use this head tracker having along with HMD.

So, while using the HMD in inside this HMD you can actually visualize means actually you can feel that how you are immersed inside that environment. So, whenever you are walking in that environment whenever you are moving your head in different directions. So, the head tracker will help you in tracking your head movement. So, these are the equipments basic equipments for the virtual reality.

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Then this is the main equipment with which you can feel the immersiveness of the virtual reality which is the most important part in the virtual reality. So, while wearing this particular HMD inside you can see that you know you do not have to see outside anything. So, everything every end developed environment you can see and feel inside it whenever you will be walking inside you can feel that you are immersed in that environment; environment and you are walking inside that environment.

Apart from this we are having a eye tracker, so these are basically used for the purpose of situational awareness now it is trending in the marketing research. So, it can capture your eye movements whenever you will wear this and it will be connected; connected to a particular computer. So, you can feel that whenever where is your gaze direction. So, particularly in a safety domain; safety domain if you are working, then one person if he is looking at one hazardous situation or different kinds of accident scenario, then you can automatically detect that

what that person is looking at and which is the most high a severe accident that is going to occur. This is these are the equipments we are having inside our virtual reality lab.

Thank you Kranti. So, could you talk about some of the applications of virtual reality particularly in the industrial context and more specifically something that the lab is interested in.

So, virtual reality application is very wide it is mainly used in the industry mining industry, healthcare industry and manufacturing industry. In mining industry basically it is used to train the underground coal miners, whenever they are going to a very complex area. This should be aware of the things that they are going to face inside that underground coal mine.

Similarly, if a surgeon is going to operate on a particular patient. So, remote kind of surgery you can perform with the help of virtual reality and apart from that in manufacturing industry different assembly automation simulation and how to accidents accident simulation kind of thing we can perform in the manufacturing industry. Apart from that we are nowadays fire workers are also; fire fighters are also trained with the help of virtual reality how to tackle with the emergency evacuation situations.

Wonderful yes, so could you please take us through one of the scenarios yes particularly something that you have, so we can see on the screen.

Yes, so we are currently working on a accident development scenario. So, we have developed a particular factory simulation fact workplace in scenario where we experience some of the accident situations.
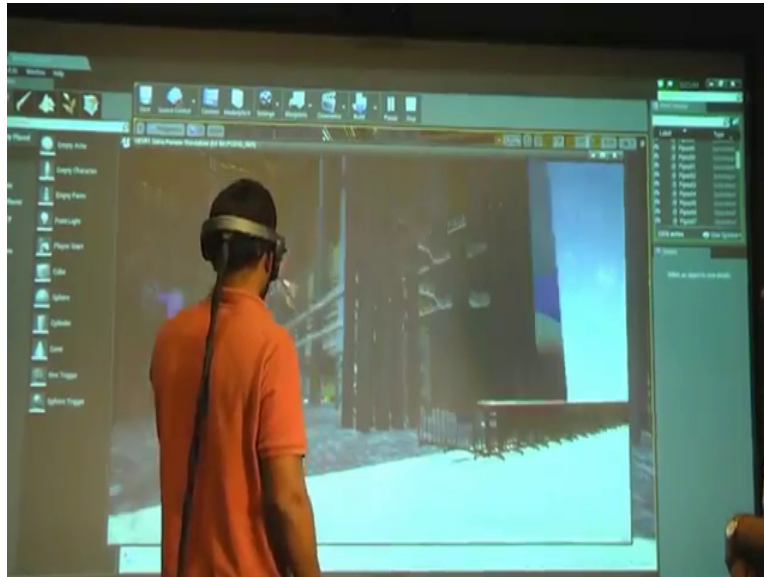
So, I am taking you through the accident workplace I am taking you into the workplace you can see visualize that, this is the complete workplace we have developed in a certain span of time. So, what we did is for this we have to collect some particular data how to develop these 3D models. So, in the first phase we developed the 3D models, you can see all the 3D models that is developed with the help of the software's like solidworks, then Google sketch up, then Maya this kind of software we used for the 3D modelling.

Then after the 3D modelling we focused on the texturing; why texturing because texturing gives you the real feeling of the 3D models that are present in the environment because real virtual reality in the virtual reality we have to mimic the real environment. So, we have to give the textures particular textures for the particular objects. Then we did all kinds of all kinds of simulations with the help of a game engine that is unreal engine we imported all the models to that.

Then according to our operation; according to our requirement we created different kinds of accident scenarios and different kind of simulation standard operating procedures those are followed inside this particular environment. So, this is the complete demonstration of the project we are working.

So, Kranti let me ask you that what is it that you are able to see inside this particular HMD.

So, if we will wear this particular HMD, so we have created the complete environment in the desktop. There are two kinds of VR that is one is your come display base VR, projection based VR and second is your computer VR desktop VR.

So, what you can do is you can you will see this complete environment in a desktop parallelly you can see this complete environment in a VR, but in desktop VR you cannot feel that immersiveness in the projection VR that you will feel. So, whenever I am wearing this particular HMD, so I am feeling that I am particularly working I am feeling that I am working inside that environment. So, if I will move in different direction, I can see that this is the different equipments are present, this is the facility design in the particular workplace.

So, if given to the operator if operator will perform some operation I will be acting as a operator. So, I will be going to the particular operation designated work place and a perform my operation. So, I can do by myself and I will act as a particular user inside that environment.

So, that is great ;so thank you Kranti and as we have seen that with the help of virtual reality instruments infrastructure and so on like the HMD, the different VR glasses and so on. One is able to emulate and get trained in different; different scenarios in even before the actual scenario is encountered. So, as Kranti was saying there are different; different scenarios where VR can find applications. For example, for training in the mining scenarios, health care where the doctors can perform some kind of doctors can practice even before actually performing the surgery and so on thank you Kranti.

So, let me now ask Professor Maiti is there anything else that we should know about the VR facility over here? Yes, this VR facility is a unique one and I also thank Kranti that he has given good explanation to this, to add to his explanation I want to tell you that there are different stages for ultimate VR that modelling and simulation and tracking. First one is the we have the high end system, computing system basically for the image first image generation and which is basically projected through a projector or a set of projectors will be good one at present we have one projector.

So, first is image generation, second is image projection and then there is there comes the once the industry environment or the actual environment is created and it is component and every other things then working is simulated synchronized, then the ultimately how to interface with the user. So, we have so many equipment what Kranti already shown to you, primarily the hand gloves then head and hand tracker and then using all those things and the navigation system with the sensors you will be basically immersed in the environment.

And then whatever you want to do as per pre-planned program that you can do that particular kind of things. And from application point of view what I can tell you that it is enormous, particularly although we have started this lab from the accident causation modelling and simulation point of view and that this kind of work can be done in any kind of industries. But apart from this suppose the virtual prototyping in the area of product development and in medical healthcare system particularly from the operations point of view, the pilot who is basically running the plane aircraft that for his y training point of view.

And hazardous systems like a violent gas, mining, chemical, steel manufacturing even in when working or developing something below the sea that mean under the water. So, it is huge and that is what I wanted to tell you.

Thank you Professor Maiti for adding to the information that we already have and so as we have seen that there is enormous potential of the use of virtual reality. So, it can be used for varied application starting from training of pilots who are running the aircrafts for underground mining, coal mining or other types of mining.

Underwater works, high hazardous situation I think that situation in working at height right, so many things can be done here.

And also from who trained the fire safety workers and so on.

And driving; driving particularly on road driving train drivers, so there are many different types of applications of virtual reality and so far depending on the type of industry the virtual reality environments can be created for the specific type of problem that is being addressed. And so it has lot of applications for industrial uses.

Particularly in the are of industry 4.0.

For industry 4.0 and industrial IoT virtual reality has lot of applications. So, with this I would like to thank once again Professor Maiti and Mister Kranti thank you so much.

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There is very another very exciting equipment which is the 3D laser scanner which is also used in VR facility. So, this is this one this instrument that you can see in front of you. So, I would like to ask Kranti as well as Avidev could you please explain about this particular instrument how it works?

This is a digitizing device, we can say 3D laser scanning. What it does it captures the environment data, if we do not have any kind of 3D model or any 2D drawing of any workplace or any kind of environment. So, we capture the digitized form by the 3D laser scanning and we can get directly 3D models or any kind of category. So, it is a very handy thing we can go place it anywhere and we can get the 3D data. So, this is the plus point of it used for this regeneration of any kind of model for any kind of environment ok.

So, moreover I want to add that if you are having complex or intricate shapes in a particular your location which you want to model. So, if you are not getting proper data for that how to model it. So, what you can do is you simply take this equipment and place at that particular workplace, it

will scale up to 500 or 600; 600 meter distance. So, it can capture all the more components present in that particular workplace in the form of a point clouds.

So, ultimately the point clouds will be connected through a software that will give you the output as a 3D model. So, instead of giving more time to 3D modelling software and developing the 3D models, we can directly use this and obtain the 3D models as a final product.

Great thank you basically; basically something like we in order to create the actual industrial environment the 3D modelling what is required in VR models. So, we can just use this equipment in order to get the 3D model get the three point clouds and then through the software or through program get the 3D environment and straight way using the that VR system.

You see right the virtual reality scenario.

That scenario.

Thank you.