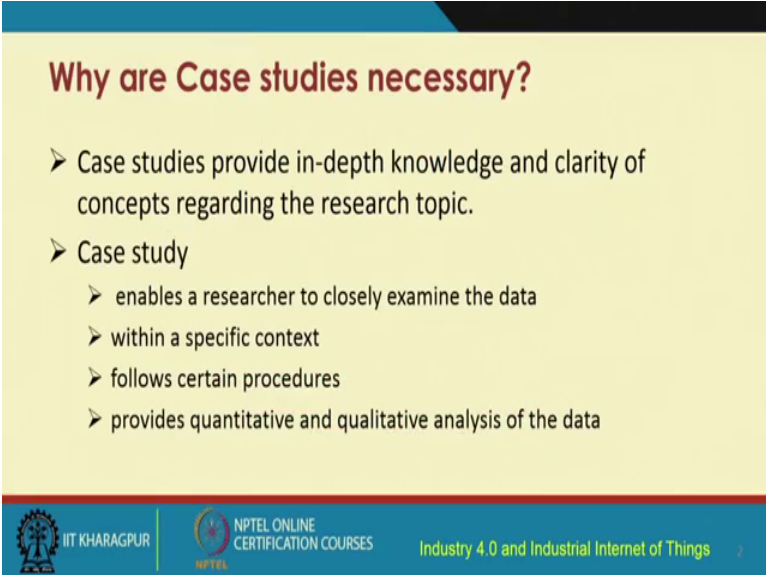**Introduction to Industry 4.0 and Industrial Internet of Things**
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Lecture – 58
Case Studies for Industry 4.0 & IIOT

So, in the next few lectures I am going to cover a few Case Studies on the topics of Industry 4.0 and industrial IOT. So, so far what we have done is we have looked into some of the fundamental issues of IOT and particularly concerning the networking aspects, the sensing networking actuation and so on. Thereafter we looked into the business aspects of it and also some of the very important technological aspects particularly concerning the networking issues in IIOT.

So, it is now very important to understand how these technologies can be adopted by the industries that are advancing themselves towards efficiency. So, what is a case study first of all? Let us try to understand that.

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So, case studies are very important because they provide in-depth knowledge and clarity of concepts on a particular topic and in our case we are talking about the industry 4.0 and industrial

IOT as the topic. So, we need to understand in-depth whatever concepts the fundamental knowledge that we have acquired in the previous lectures.

How they can be really used to address a real life problem; that means, whatever the industries are using how the industry 4.0 and IIOT concepts can be adopted to transform themselves towards improved industry, industrial processes and products. How they can lead to you know if you are improving the industrial process, then automatically the quality of the product, the efficiency with which these products are made everything is going to improve.

So, we are going to look at some of the existing cases and we are going to follow from that point on and try to really ponder upon how things can be improved in our existing industries through the adoption of industry 4.0. So, basically a case study would enable one to closely examine the data within a particular context. So, it is context specific which certain procedures will have to be followed in order to understand the case and a case study would also provide qualitative and quantitative analysis of the data.
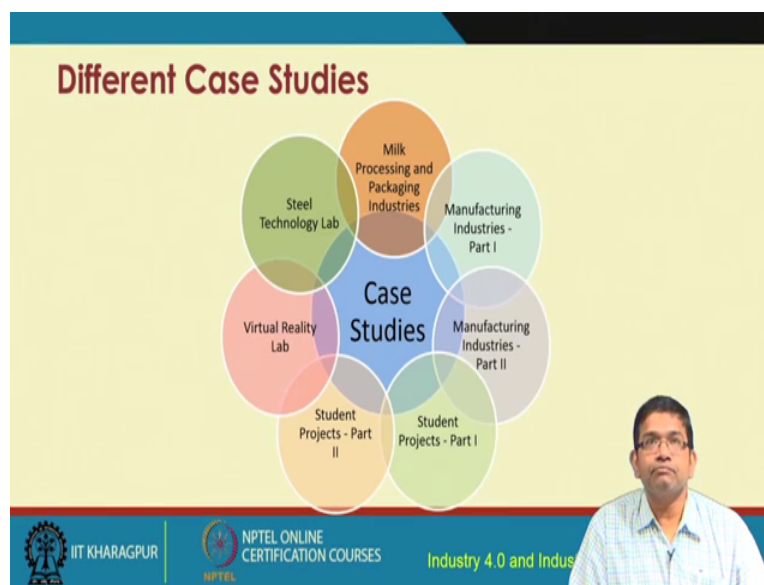
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So, case studies would explore and investigate a real life phenomenon through the detailed analysis of related events and as I said that in our context we are talking about real-life industry, real industries, real functioning industries, that we have visited we have collected different

information about real life industries which are doing very well, but then how they can improve their business processes, how they can improve their efficiency, how they can improve their technological processes towards improved efficiency of the business through the adoption of industry 4.0.

So, in a case study basically you know what happens is you pick up a particular case which could be a geographical area or maybe you know it may concern a particular industry, it may consider a few individuals or whatever be the subject. So, you need to first define which subject we are talking about..

So, once we have fix the subject, we need to really understand how understand in detail how the things are already taken place and then through the technological intervention how the existing processes can be improved. This is the whole purpose of the use of case studies in this particular context in our context of industry 4.0 and industrial IIOT.

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So, there are different case studies that we have prepared for you. In this particular course we have gone out to the real industries we have connected with real industries and these industries are in different parts of our country, particularly focusing on the western part of our country; that means, India and we have collected, we have gone to the different industries, we have reached

out, we have understood their existing processes, we have recorded what they have what they do in practice and we have tried to bring these up for you.

So, that you can also try to analyze and try to understand how whatever you have learnt in terms of the technology, the business in the several lectures in this course how you can use the knowledge in order to improve their business processes. So, you would be analyzing those things. So, it is not necessary and in most cases it is not the case that the existing industries that we have contacted, that we have collected the data from which we have recorded it is in most cases you will find that they do not already have the high standards towards industry 4.0 and industrial IOT solutions.

But, they really understand that they need to improve their existing processes. So, they are very keen on that option part, but they at the same time they do not have good understanding about what needs to be done. So, we will take up these raw businesses, their raw data that we have collected and we will analyze ourselves that how we can improve their processes, how we can what we can suggest to improve their processes and then those suggestions can be adopted by them or not that is up to them, but we can analyze these things and we can give a prescription for them about what they they could do in terms of that option of industry 4.0 and industrial IOT technological and business solutions.

So, some of these industries that we have visited are the milk processing and packaging industry, we have visited some manufacturing industries different case studies I am going to show you in the next few lectures about all these industries, what they are doing we have video recorded, we have collected these data for you so that you can see live what is going on. And, we have beyond this milk processing and different types of manufacturing industries and so on and so forth.
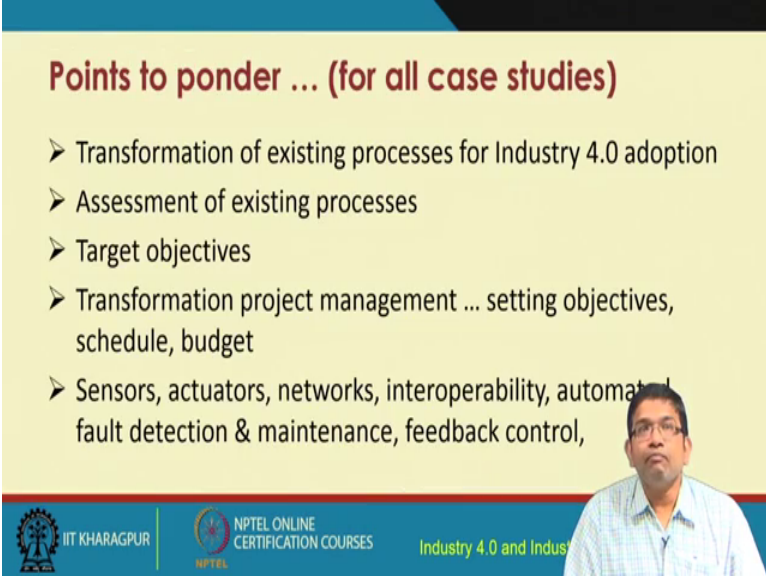
We have also given you some of the cases about some state of the art laboratories in our institute. The steel technology lab; so what they are doing. So, they have very advanced facility particularly in terms of the welding, the welding machinery. So, you know how they are using, how they are transforming themselves gradually gradually towards the adoption of industrial IOT solutions you are going to see that.

You are also going to look at some of the student projects some of the students mini projects that they have done in the course that I teach over here, the semester course that I have that I teach over there some of these mini project can give you some idea about how you can gradually build up through the use of these small-small building blocks how you can gradually build up and transform some given industry as a prescription how you can transform them towards industry 4.0 adoption.

And, the last thing that I would like to mention is there is a very state of the art virtual reality lab in our institute that that I am also a part of and we have built it together. And, in this lab the virtual reality machinery that is there, how that can be used to towards the transformation process for industry 4.0 we are going to have a look a virtual tour through this virtual reality lab.

So, so many rich content that we have prepared for you just so that you can understand better what goes on in the real industries and the different labs and how we could transform their processes to improve their existing processes towards betterment.

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So, while you go through each of these case studies in the next few lectures, please try to think about what transformation you would prescribe you would prescribe for their existing processes towards the adoption of industry 4.0 and industrial IOT based on whatever you have learnt in the

previous lectures the fundamentals the applications the technologies, the technological solutions, the business solutions and so on, the business architecture and so on. How you could use those existing knowledge that we have covered, we have taught you in the previous lectures how you could use them in order to improve their processes better.

So, remember one thing that none of not none, but in most of the cases these industries are not there yet they are trying to theyare striving towards improvement and they do not really always understand what they will have to do. So, this is an opportunity for us to analyze what is existing and preparing a prescription for them, right. So, take it in that particular way. Do not think that the case studies the recorded content that we will show you in the next few lectures will already have their advance technologies towards industry 4.0 and industrial IOT. They do not already have that, they are not there yet, but what could be done analyze the content in that perspective.

So, we need to what we need to do we need to really first understand what is going on through those videos that we are going to show you next. You first understand you need to understand and assess their existing processes, then set up some target objectives towards this adoption, set up these target objectives and then transformation activities will have to take place. So, the transformation itself is a project.

So, what all project management objectives, what all aspects of project management will have to be taken care of in terms of number one setting the objectives clear constraint by the facts of budget schedule and so on. So, how you can set the objectives for them? Then the last thing is think about whatever you have learnt in terms of the sensors, the actuators, the networks that is the beauty about industry 4.0. Connectivity – connecting the different machinery, connecting the different objects, one industry with another industry within a particular industry connecting different different machines, tools, technologies, people processes and so on full connectivity how you can improve the connectivity. So, this is something very important.
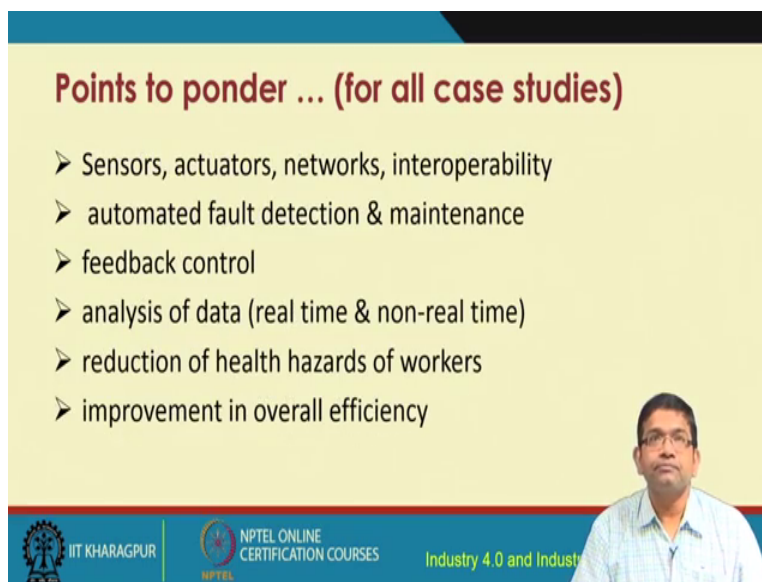
So, so, what we need to do is to understand those things and also interoperability. Something is already existing, there is no point in completely removing the existing processes and building things from scratch that is not good. So, how you can how you can come up with a solution that can serve as an interoperability solution between the existing technologies and the suggested technologies which are going to improve their processes.

So, automation, full automation we need to have we need to strive towards fully connected fully autonomous systems with reduced or ideally no human intervention. So, how we are going to do that while taking care of issues of automated fault detection, automated maintenance. Feedback control; feedback control is very elementary feedback control will. So, basically what happens is let us say that there is some machine which is doing a job there is some machine which is doing a job. Then what needs to be done is that you collect the data you with the help of some sensors which are relevant.

Then, based on the sensors sensor data that is collected you need to send the data through a network, analyze the data analytics is very important consequently analyze the data and based on the results of the analysis you send a feedback message back to the machine for example, and based on the feedback signal that is received by the machine, the machine is going to improve upon what it is already doing in a to improve upon their existing job that is being done by it right.

So, it is a very you know it is a very tied up kind of loop with everything put together sensing, actuation, connectivity then analytics and feedback control everything put together and everything remember one thing that everything is connected and consequently, there has to be reduced human intervention or no human intervention as I said before.

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So, for every case study my suggestion to you would be think about whatever you have learnt in the previous lectures; think about for every case that we present which sensors are going to be required in order to address the problem that they face which sensors are going to be required because the sensors are going to be the connectors of the raw data about what is going on with these machines these pre processes the business and so on which sensors are required, which actuators are required, which networks would need to be deployed in order to send the sensed data and also the signals to the actuators and so on.

So, which network many many cases you will find that it is not a single network that we are talking about, it is a collection of different-different networks in the different parts of the system. So, how these different networks following different standards, following different you know protocols and so on how they are going to work hand in hand. So, interoperability consequently becomes important.

Interoperability in terms of the devices, device level interoperability, standard level interoperability, protocol level interoperability and also application level interoperability different diverse varied applications how they can hand shake and talk to each other. And, also think about automated fault detection, automated maintenance, automated anything that you can think about that is going to improve their existing processes and consequently monetarily they are going to be improved and that is why they are going to strive towards the adoption of industry 4.0 and IIOT solutions.

So, keeping that in mind it is not going to be that you know you you introduce you suggest the introduction of any technology it is not like that. Think about what is their problem, think about what you already know about industry 4.0 and IIOT and think whether and how these existing concepts can improve their processes, and what prescription could to be meet to them and then we leave it to them to think about whether they would like to adopt whatever suggestions that we give for them.

So, that part we will leave out you know it is going to be out of the scope of this particular course. We will only do the analysis ourselves and we want to restrict to that only and I know so, that way you know so, we know that what has to be done, but we really do not go and reach out to them and try to convince them to adopt these solutions.

So, feedback control is also very important as I said before. So, you need to have a proper control machinery in place because without the feedback control you are not going to improve the existing processes in an autonomous fashion, right. So, so proper feedback control in place has to be there. Analysis of data both real time non real time data; the analytics itself is core to industrial IOT. So, analytics is very very much integral to it. Reduction of the health hazards of the workers and improvement in overall efficiency.

These are some of the different issues that you should think about how you can look at these existing these cases that we are going to present and analyze in respect of these different issues, these different attributes.

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So, these are some of these different references and with this we come to an end. Keep in mind whatever I have said that take up each of these different cases and think about the items that I have listed in the points to point out in this particular lecture.

Thank you.