Introduction to Industry 4.0 and Industrial Internet of Things
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Lecture – 61
Manufacturing Industries – Part II

So, right now we are in another company which is the Atomic India Private Limited. This particular company it is in the business of making the rims of wheels of motor cycles and bicycles. So, these are some of their products. So, this is one such rim of a motor cycle, and this is the rim of a bicycle.

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So, this is basically what they make. And so I have with me Mr. Sanjay Patel. He is the managing director of this company. So, we are going to ask him about what they exactly do, but before that I wanted to talk about the level of maturity of automation industry 4.0, compliance and so on. So, this is a company that I choose not because they are matured enough for the adoption of industry 4.0, in fact it is the other way round. So, this is a company which not so much yet, it is a small scale company, it is a small company which is not very much matured yet in terms of automation and industry 4.0, but this particular company is one where you know if we take it up as a you know if we take it up as a case, we can see that how we can adopt different, different

technologies that we have studied in our course in order to confirm this company towards the adoption or transformation towards industry 4.0 and compliance thereof.

So, there are lots of opportunities you will be able to find in this company of the technology that you have learned from the business aspects of it, all of these could be very well adopted over here. So, as you can see in front of you this is basically the actual the raw sheet metal that comes, and then behind me is the roll forming process that basically you know what it does is it does some preliminary processing and then preliminary processing basically includes stuff such as stamping the sheet metal with the company logo the name of the company and so on the brand name and so on. So, all of these things are done. And also there are two preliminary processes that are done. We will ask Mr. Patel about exactly how things are done.

So, we will talk about later on you know what is the current state of the practice, what is the current state of the art over here, and what all things can be done if they want to transform themselves towards industry 4.0 adoption. So, automation is low in this company, the use of sensors is also very low, and definitely you know analytics particularly from an automated analytics point of view, predictive analytics and all of these things are pretty low in this company. But these this is a company which has lot of potential for transforming themselves towards high end automation and high end adoption of industry 4.0 requirements.

So, Mr. Patel could you please explain what exactly you do in this company. [FL] product [FL] cycle [FL] motor cycle [FL] steel wheel sports wheel [FL] process [FL] process [FL] start [FL] raw material [FL] requirement [FL] crcs strip [FL] thickness width [FL] coil [FL] hang [FL] coil holder [FL] coil holder [FL] strip role forming machine.

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[FL] brand name [FL] company [FL] brand name [FL] strip [FL] firm [FL] step [FL] step by step [FL] roll [FL] pass [FL] firming [FL] firming [FL] process [FL]. So, I am now going to request Mr. Sanjay Patel the managing director of this particular company to talk about the entire process, you know what things are done how it is done and the current state of the practice. So, Mr. Patel basically as I have told you that we are using this thing for educational content which will be made accessible to people who do not normally have high end education in our country through online media. So, it is going to be made accessible to the NPTEL portal. So, could you please tell us that how this process is conducted you know what exactly happens so what here?

Ok sir, thank you sir. Hundred percent Gujarat [FL] basically [FL] main [FL] product [FL] cycle rim (Refer Time: 5:08) cycle [FL] motor cycle [FL] moped [FL] bullet [FL] rim [FL] sir [Fl] main aim [FL] rim [FL] process study [FL] process [FL] complete [FL] start [FL] coil holder [FL].

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Coil holder [FL] raw material [FL] lift [FL] machine [FL] pass [FL] strip cycle [FL] [FL] steel spoke wheel rim [FL] basically [FL] steel wheel rim [FL] strip [FL] strip [FL] thickness [FL] width [FL] important [FL] rim [FL] weight [FL] load [FL] pass [FL] role forming machine [FL] center [FL] forming machine [FL] plate [FL] weld [FL] seam welding machine [FL] seam welding machine [FL] [FL] rim [FL] fold [FL] cut [FL] cut [FL] butt welding [FL] joint [FL] butt welding machine [FL] [FL] butt welding pass [FL] [FL] grinding [FL] polishing [FL] rim [FL] size [FL] 193, 320, 400 or 600 [FL] grade [FL] polish [FL] polish [FL] important role [FL] polish [FL] chrome chrome [FL] nickel [FL] nickel [FL]polish [FL] polish [FL] market [FL] requirement [FL].

40 hole [FL] 36 hole, 32 hole, [FL] market [FL] product [FL] customer [FL] demand [FL] application [FL] depend on application [FL] diameter 28 [FL] rim [FL] cut [FL] number of hole punching [FL] punch [FL] process [FL] mechanical process [FL] [FL] nickel [FL] process [FL] nickel [FL] strip [FL] oil [FL] remove [FL] remove [FL] H 2 SO 4, HCL, super soap [FL] chemical [FL] rim pass [FL] complete rim pass [FL] wash [FL] nickel [FL] nickel [FL] line [FL] 8 to 9 [FL] micron [FL] gram [FL] nickel [FL] nickel [FL] anti corrosion [FL] rim [FL] like [Fl] chrome [FL] process [FL] chrome [FL] Process [FL] polishing [FL] shining [FL] different chemical [FL] pass [FL] rim [FL] rim [FL] pack [FL] market [FL] automation [FL] automation

[FL] process automation [FL] sir [FL] automation [FL] automation [FL] plc [FL] plc [FL] uses [FL].

Or sensors [FL] temperature sensors [FL] plc automation or sensing [FL] use [FL] automation [FL] automation [FL] roll forming machine [FL] start [FL] problem [FL] plate [FL] thickness [FL] width [FL] roller [FL] problem [FL] machine [FL] plc [FL] set [FL] thickness [FL] mm [FL] machine [FL] automatically [FL] number 1 [FL] number 2 [FL] rim [FL] folding [FL] seam welding [FL] seam [FL] for example, [FL] 250 kva [FL] power [FL] suppose by chance [FL] power [FL] supply [FL] customer [FL] problem [FL] number 3 [FL] rim [FL] market [FL] demand [FL] [FL] 28 [FL] cutting [FL] rim [FL] size [FL] PLC [FL] possibility [FL] process [FL]

Number 3 [FL] PLC [FL] polishing [FL] rim, [FL] polishing [FL] polish [FL] chances [FL] PLC [FL] requirement measure [FL] last [FL] chrome [FL] percent [FL] gram [FL] setup [FL] temperature maintain [FL] chrome maintain [FL] nickel [FL] maintain [FL] meter [FL] maintain [FL] instrument [FL] total plant [FL] requirement [FL] nickel plant [FL] nickel [FL] tank [FL] machine [FL] process. [FL] Suppose [FL] requirement [FL] nickel [FL] 65 [FL] temperature [FL] 40 [FL] rim [FL] maintain [FL] plc possible [FL] sensor [FL] use [FL] electroplating [FL] temperature sensor [FL] important [FL] temperature [FL] temperature [FL] important [FL] nickel [FL] temperature 70 [FL] 65 [FL] temperature maintain [FL] nickel [FL] atom [FL] atom [FL] speed [FL] dependent [FL] nickel [FL] temperature [FL] temperature maintain [FL] nickel metal [FL] metal [FL] speed up and down [FL] first [FL]

Below 50 [FL] nickel [FL] part [FL] speed strip [FL] quality maintain [FL] [FL] chrome utilizers [FL] chrome [FL] process [FL] above forty [FL] by chance [FL] [nickel] [FL] chance [FL] below 40[FL] chrome [FL] 40 [FL] automatic shut down [FL] temperature maintain [FL] below 40, 45 [FL] automatic [FL] shut down. [FL] Number 3 [FL] chrome [FL] layer [FL] important [FL] layer [FL] by chance [FL] chrome [FL] maintain [FL] chances [FL] ok, yes, Thank you, so, Mr. Patel, thank you so much.

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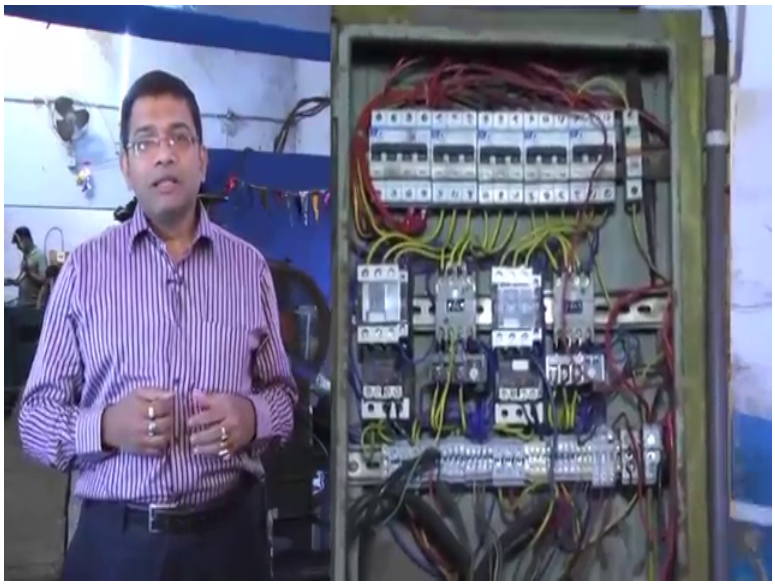

So, what we have seen is that in this particular company there is some automation, they use PLC - Programmable Logic Controllers, which you have studied in this particular course. They also use different sensors. So, this is basically the first step, but there is a long way to go. So, what is required as you know already that?

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The sensors are there, but they are not interconnected. So, data is being acquired, but you know if you can have a system where the data can be exchanged you know, so the data from the different sources the different sensors they all can be made available. And if we can have a process by which centralized decisions can be made. So, after the sensing of the data, the data will have to be sent, so that communication the communication aspects, the protocols that are there which you have studied in this course, all of these are going to be required they have to be implemented.

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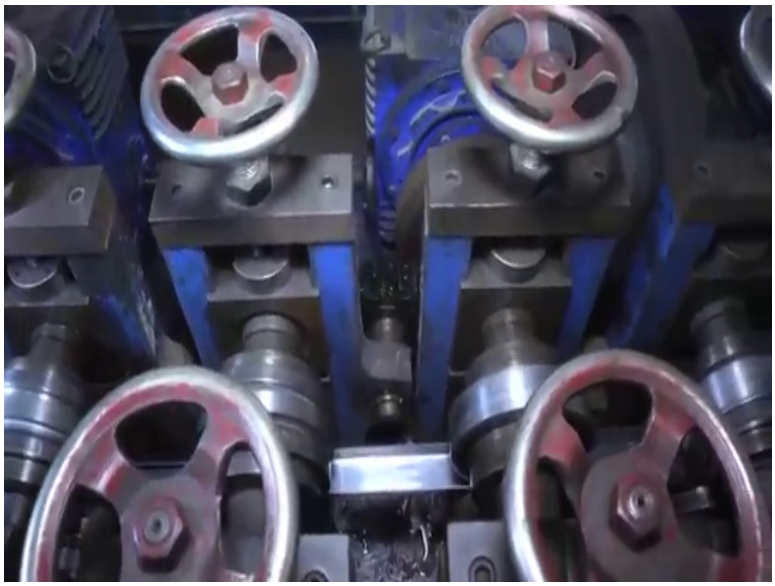

So, I was telling you that after all this data are made available in a centralized manner or some decentralized manner as well. So, they have to be processed. They have to be processed close to the age, that means, the source from where they are being connected or they have to be processed you know far away from it may be in a cloud or somewhere like that.

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So, all of these technologies the form computing the cloud computing all of these technologies could be very well adopted in this particular company to improve their processes.

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So, thereafter what happens is you can based on analytics, you can make decisions, decisions about the first of all you know we can monitor the operational efficiency. We can monitor the operational efficiency operational maintenance either anything is required or not based on the

data that are being collected. Then there after you know predictive as well as prescriptive maintenance using machine learning techniques, those can also be adopted. And so what we can do is we can make the processes, the quality of the products in turn much more improve and of better quality. [noise]

One more thing that I forgot to mention earlier is what about safety, safety is very important in most of the industries. And I am sure they are also taking care of safety in a very serious manner, but you know automation in the safety domain is very important. So, can we adopt the IoT technologies in order to make the work place much more safe and also the processes much more improved, so that you can you can take care of the quality overall in a much more improved manner and in a much more integrated manner. Why I say integrated is all of these things will have to be interconnected, all these different components, all these different data that are coming, all these should contribute in a holistic manner in an integrated manner in order to improve the processes, the product quality as well as the work place safety.

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So, this is a company as I was telling you earlier which has taken the first steps, but there is a long way to go if they are willing to adopt industry 4.0 in the future. So, adoption of IoT technologies will help them in order to achieve the goals thank you, thank you.

So, right now we are in another company which is basically into the business of taking sheet metals and giving it some kind of a shape for its clients. So, the name of the company is Metal Texigency Private Limited in North Gujarat. So, I have with me Mr. Patel who is going to explain to you about the company. And so this particular company as you will see has lot of opportunities for adoption of the high technology industrial IoT and industry 4.0. We will talk about that later on. but let us first ask Mr. Patel about the company to speak about the company. My name is Bharath Patel; managing director from Metal Texigency Private Limited.

Ok.

We are manufacturing sheet metal component and fabrication.

Ok.

So, as I was telling you Mr. Patel. So, this particular course that we are doing is for it the name of the course is Introduction to Industry 4.0 and industrial IoT. And this is an NPTEL course which is going to be made accessible to students from all over the country and even beyond. And so we are going to look at you know the different types of instruments that you have over here, and what is your current state of the art and how we can take it forward in order to adopt in the industry 4.0.

So, we are going to talk about that later on, I am going to talk about it. My name is Keval Ganvir. My designation is production engineer in metal technology.

First of all [FL] drawing [FL] [FL] drawing [FL] Autocad [FL] drawing [FL] drawing [FL] machine [FL] software [FL] convert [FL].

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[FL] cutting [FL] hole [FL] square [FL] cut out [FL] programming [FL] machine [FL] CNC punching machine [FL] CNC machine [FL] CNC panel [FL] program [FL]

Program [FL] office [FL] software [FL] memory card [FL] program transfer [FL] card [FL] panel [FL] program [FL] detail [FL] machine [FL].

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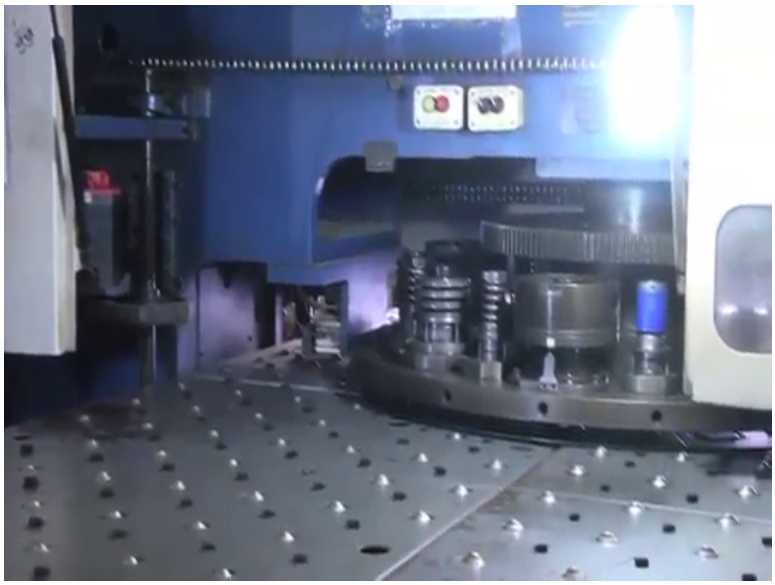

28 station [FL] number [FL] round [FL] number [FL] full requirement [FL] program [FL] operator [FL] tooling [FL] detail [FL] manually [FL] set [FL] complete [FL] punching [FL] punching process [FL] [FL].

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Punching machine punching process [FL] shearing machine. [FL] shearing machine [FL] points [FL] square [FL] left [FL] up down [FL] cutting [FL] single part [FL] bending machine [FL] degree [FL] bend [FL] 90 degree, [FL] 45 degree [FL] bending [FL] bending process [FL] complete [FL] powder coating [FL].

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Phosphating [FL] 7 time process [FL] phosphating [FL] crane [FL] lift [FL] 7 time process [FL] dipping [FL] complete [FL] phosphating [FL] clean [FL] complete [FL] powder coating [FL] manually [FL] manually [FL] conveyor [FL] automated [FL] automatic [FL] color [FL] color [FL] color [FL] side [FL] side [FL] painting [FL] conveyor [FL] complete [FL] painting [FL] spare part [FL] colored [FL] model [FL] ton [FL] [FL] outdoor [FL] part [FL] base [FL] left right [FL] top [FL] parts [FL] parts, parts, [FL] fitting [FL] screw [FL] fitting [FL] box [FL] very good [FL] model [FL] box type, [FL] component [FL]

Ok, thank you so much for explaining the entire process.

So, as you have seen that this is yet another company you know which is basically let me just you know repeat the whole purpose of you know what they do. So, this particular company is into the business of taking sheet metals and making different spare parts for air conditioners including the body of the air conditioners, the outdoor unit of the air conditioners and so on. So, basically as we have seen that it starts with the sheet metal and which is taken into the CNC machines CNC machine as you know is the computerized numeric control machines which are bit different from the PLCs which are the programming programmable logic based machines. So, in this CNC machines basically you know what happens is you know the weight is different from the PLCs is that in the PLC it is the sequential operation and in the PLCs. And in the CNC

machine, it is the conditional you know execution of the program, and so both of these the CNC as well as PLCs have lot of similarities.

But there are certain differences between the operations of the CNCs and the PLC machines. PLCs as well as CNC machines both are used in factories the manufacturing plants and other similar plants a lot. And so these are some of the essential components for making the company smart, but for smart factories and so on for smart manufacturing what is required is the adoption of industrial IoT concepts that you have learned in the course. So, lot of lot of different things are required in it. It starts with the sensors not just the sensors the sensors which are connected inter connected with one another.

So, the interconnected sensors, the sensor network which are fitted to the different machines not a single machine, but different, different machines, they are all fitted with these different sensors, and they can share the data between each other and also to a remote you know point where it has to be processed further. So, all these data are collected let me just repeat the process once again, and then you know undertake different, different analytics, may be some of these could be real time analytics, some of this could be non-real time analytics.

Some of this could give you idea about the quality and the processes that are being conducted the quality of it you know getting different, different data about those so the operational part of it. And some of this could be predictive about you know how this data can give you certain insights about what is going to happen in the future, and so that is the predictive one and also the prescriptive ones that also you have you know how it works. So, it goes beyond the predictive analytics and you can get a lot of different insights.

For all of these you see what we have is an eco system of cyber physical systems - CPS and with that you connect different, different sensors interconnected sensors, so that is what the industrial IoT is all about. You collect the data you run different, different analytics into it. And also based on the analytics, you get different decisions which has to be feedback either to the machines or to the management in the company. So, all of these different things can be fascinating things can be done with the data that are collected, but this is we are still not there yet.

So, most of this companies are still in the primitive stages they are they still do not have you know adequate automation in them. And so basically the data that are collected you know you could even add you know scada to similar kind of systems for supervisory control and so on. So, analytics control communication and all of these things put together you know you can get a fascinating type of ecosystem that could that could be built out of these companies, and in fact what you could have is companies like this could be made smart you know they could be made smarter. So, you could have smart factories easily implemented by the adoption of all of this different ideas that I just talked about and also many different other things.

So, automation, analytics, you know communication and also the storage of the data through cloud or fog or whatever. So, all of these could be brought in together. So, we have lot of potential as we have seen in many of these companies. So, the question is that how you can take it forward what should be the next steps whether these companies are going to be interested in the adoption or not, but for that what is required is to make them sufficiently educated about what industry 4.0 is and what industrial IoT is all about.

One more thing let me repeat you know what we have covered in the course is basically the training part. The training part and particularly the training with respect to not only the systems the quality of them, the processes and the products and so on, but also the safety, safety, industrial safety is paramount. Many of these companies they take care of the industrial safety in their different, different ways, but not all of which is yet you know automated. So, if you have sufficient automation in place, you could basically you know have you know superior levels of safety ensured in the company.

So, quality, reliability, safety, all of these could be implemented and integrated in to the processes and the and the system and you could have a SCADA based you know or something similar supervisory control where everything would be monitored either in the plant itself or by the management, and the decisions could be taken either autonomously or semi autonomously, and feed back to the systems and the processes in these factories.

Thank you.