Course on E-Business
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Lecture 38 Automatic Data Capture using RFID

Today we are going to start a new topic which is about integration. But it is not about resolving the information system integration issues or about having a model where you can use a shared pool of resource. It is about automatic data capture.

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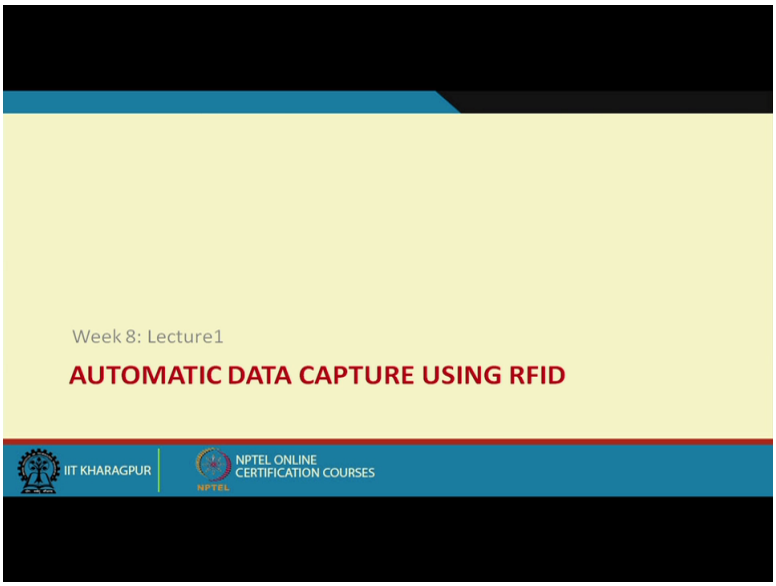

So today we are going to cover automatic data capture using RFID.

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So in this lecture we are going to learn what is the need for RFID based data capture? What is need for automatic data capture? There are basically Technologies one is barcode, another is RFID. We are going to see a comparison between them then we are going to see RFID Technology overview. How RFID has become possible in supply chain? What are the concerns in in adopting RFID Technology?

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Now what let us try to understand what is the need for automatic data capture and why and under what conditions it is only possible? We discussed about transaction systems and we know that in transaction systems whenever any transactions happen that data need to be entered. Entered by whom? Entered by some somebody for example in a retail store the sale is happening.

Now the everywhere at least there is a barcode reader. You go there the operator no more need to manually enter the data. What here she will be doing? She will simply scan the barcode pasted on the object that you are purchasing and the data gets entered. So the time which would have otherwise used in data capture as well as the human beings can mistake make mistakes?

The mistakes which the store keeper would have done that the person at the counter would have done is know about it. Now we even we can have some other Technology where this scanning of barcode that that happens in which requires a person to actually show that reader taking it close enough to the sticker where the barcode is there. Instead of that is it possible to have a technology which does not even required this much.

Once the object is is at the counter we are discussing with retailer was the objective is at the counter counter it is automatically read. So the technology of these types is called RFID Technology radio frequency identification technology. Okay? So what is this automatic data capture and why it is done? Now understood so collection and dissemination of real-time inventory data requires integration of automatic data capture.

And transfer technologies with that of your traditional ERP system. So this auto identification and data capture Technologies include include the technologies to identify the objects automatically collect data about them and update the data into a software system without human intervention. What is important what is the catch here is? The human inter without human intervention.

Now some example of such technologies includes barcode, RFID, voice and facial recognition and so on. So today we are going to talk about this radio frequency identification. It is because it is increasingly used in the supply chain.

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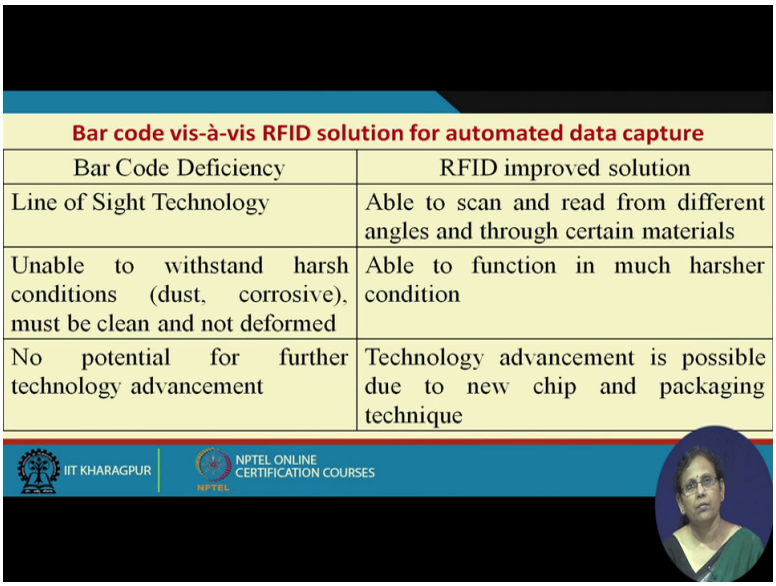

Let us have a comparison between barcode and RFID. Barcode is a line of sight technology which means you have to physically bring your reader to the to the to the barcode sticker where the code is written, code is printed. However in case of RFID you are able to scan and read from a distance and from a different angle and even through certain material.

So even if it is a package good and within that it's a barcode tag item is there it can be scanned from outside the cartoon. Now this barcode technology cannot with stand harsh

conditions and you must have seen in stores sometimes they will not be able to read it using the reading device and they have to manually enter the data. Now this RFID can function in a much harsher condition.

In case of a barcode the technology is not advancing further but here RFID technology is advancing day by day and the technological problems which whatever is is there currently are slowly getting elevated.

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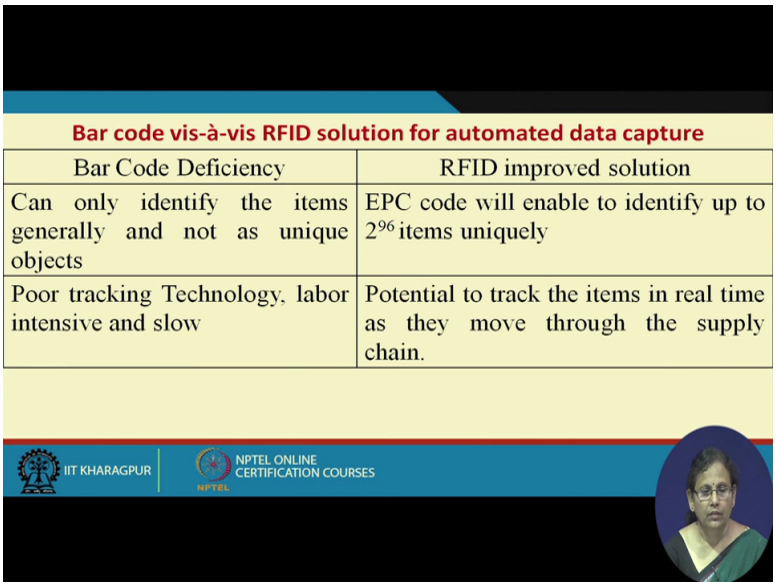

Now barcode can only identify the items generally and not as unique objects which means if you are buying if you are buying some item let's say let's say you are buying some television television will not be a good example here if you are let see if you are buying some kind of grocery items let's your buying a toothpaste toothpaste then all the toothpaste that has come in one lot possibly or all the toothpaste of a particular brand available in the store will have the same barcode.

Because of its capability to handle large number of bits which represent this information. Whereas EPC code enables to identify up to 2 to the power 96 items uniquely over the world it is a huge number. Now poor tracking Technology and labour intensiveness is two more reasons for barcodes deficiency.

Whereas in case of RFID it the item can be potentially CR draught through the supply chain auto better manner has the potential to track through the supply chain in a automated manner.

It has the potential to track. Whereas in case of barcode every time it goes from 1 supply chain member to the other it has to be 1 second scan and stored.

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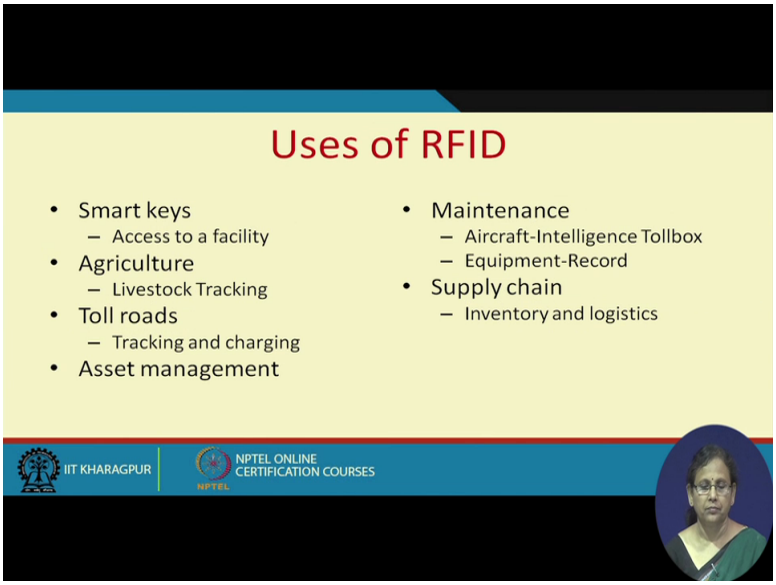

This RFID is used in many ways in many places. In fact RFID Technology if you say this technology has been in use since World War 2. It is not a new technology at all but what is new about it is its use in the supply chain. Even in Warehouse management also it is pretty old but it is comparatively newer in case of supply chain management. What are other uses of RFID?

Use of Smart keys to access certain facility, agriculture for tracking live stocks, then at toll gates, even our government has already implemented is started implementing it for tracking and charging the vehicles, for Asset Management for tracking important assets within the organisation and maintenance of of costly equipments and all then supply chain for in the supply chain which is our focus now for inventory and Logistics.

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Now RFID technology can help the supply chain in many ways. First by sending by helping to send advanced shipping notices very easily. How? When lets say you have loaded your truck with the items to go to certain place. Once the truck the with the entire item moves through a gate enabled with RFID reader all the items in the truck at a time will be read and the and no human without any human involvement.

So therefore quickly the advanced shipping notices can be made and sent. Shrinkages within the store even if the items can shrink in many ways first there can be shoplifting and items are stolen all their misplaced so therefore even if they show up in your inventory record they cannot be tracked within your they cannot be tracked even if they can sometimes they cannot be tracked if they are misplaced even if there available within the store.

Then if the items returned in case of Return Goods it is very easy to identify whether you are returning the right item or not. Then it prevents counterfeiting. Then it helps product visibility in the supply chain. It improves stock management and it reduces labour cost.

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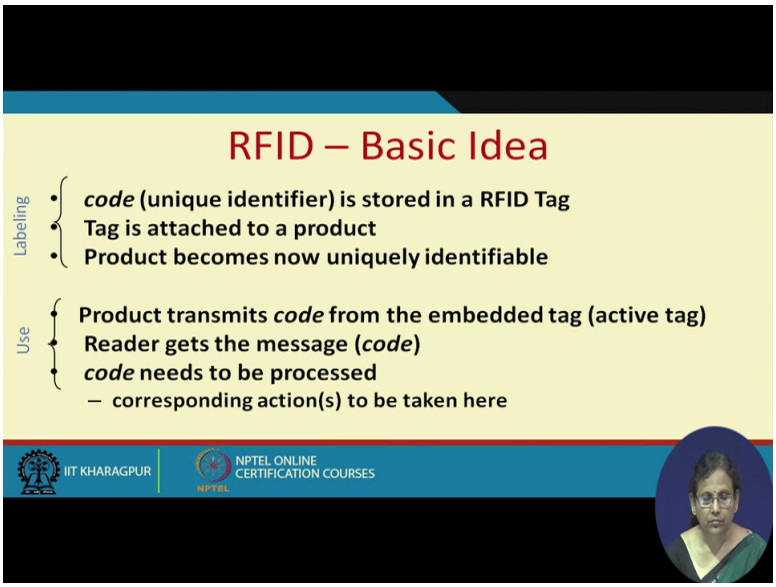

While using RFID the RFID tag Stores the information about the product and this tag is attached to a product so therefore product now become uniquely identifiable. At the time of tracking or moving the product the product once it comes in the within the field of the antenna it transmits a code from the embedded tag. Then reader gets the message then this code is processed and a corresponding action is to be taken.

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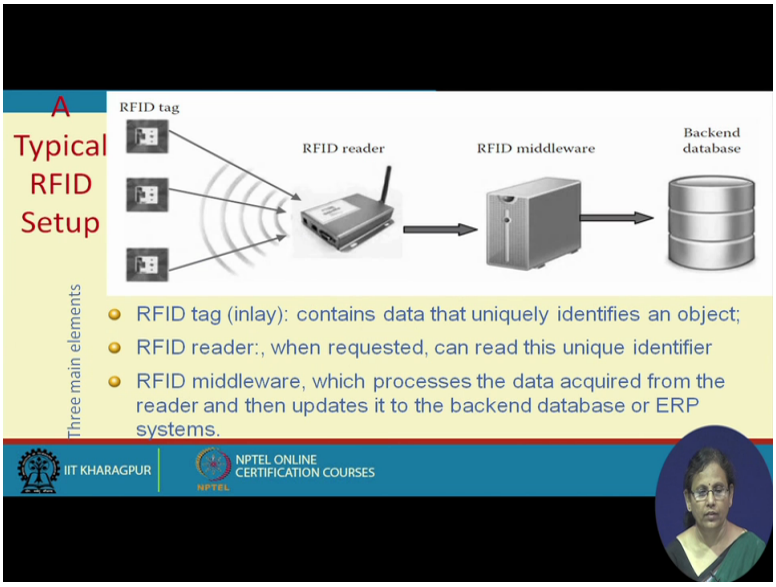

This is a typical RFID set up where the tags will be read by a reader reader intern reader occurs in the diagram we have not shown but reader intern can be connected to many antennas who in turn read the RFID tag. Then reader will be connected to a middleware

which does some kind of filtering of the data and then the data entered into the backend database.

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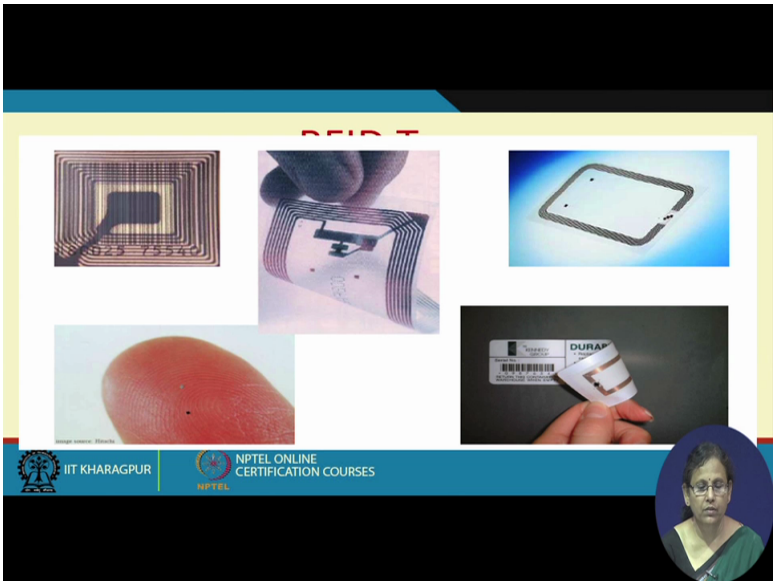

Tags come in different forms. Here itself look even a hand for possible for access getting the access to certain area the tags are inserted into the finger of somebody. Tags can be behind your barcode above it the barcode will be there and behind and the tags will be there.

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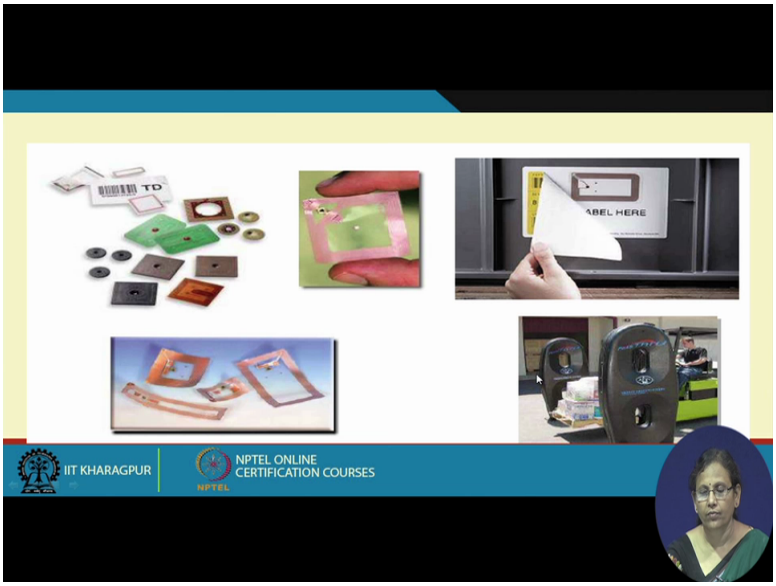

So tags come in different forms.

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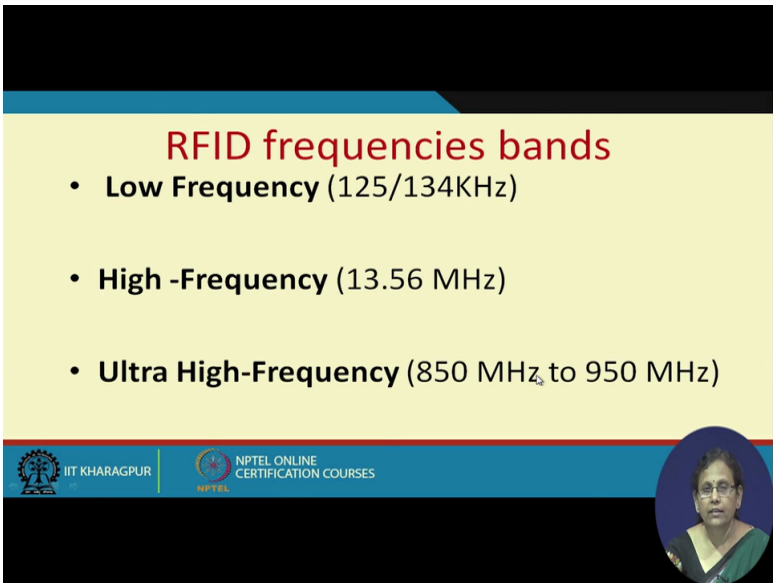

They can operate in different frequency ranges depending on their ability to store and renew the data that is stored they can be either active and then there and that and it is also how they will be able to different with them be able to communicate they can be classified into three categories.

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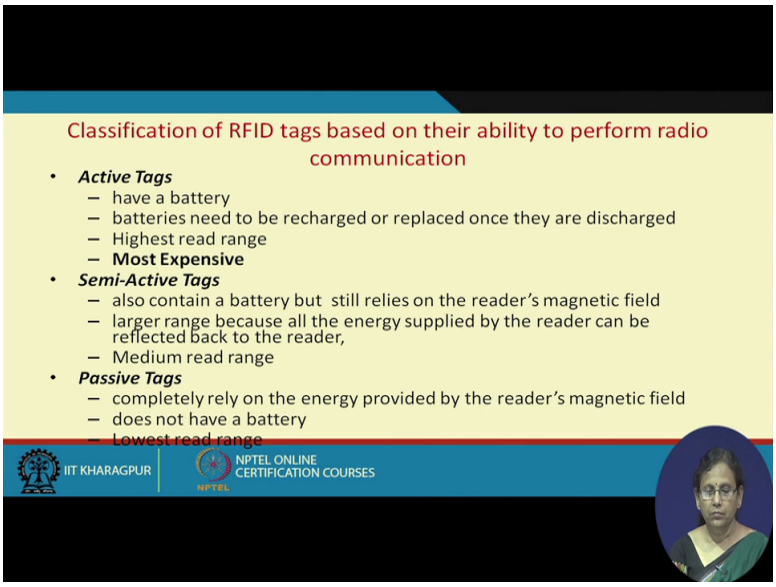

Active tag, semi active tag and passive tag. The active tags first of all let me tell you throughout the remaining discussion will be talking about the passive tag because passive tense are the one which are used for supply chain operations. Active tags and semi active tags

first of all they are costly and there are mostly used for Asset tracking and other activities. We are going to talk about Passive tags only.

But let us try to learn little bit about the active tag. These active tags are differentiated from passive tags by having some kind of power source of their own which means they have a battery whereas in passive tag they completely depend on the energy provided by The Reader's magnetic field.

Active tags are most expensive and passive tags are least expensive but there is another category of semi active tags which also contain a battery but still relies on the reader's magnetic field. Larger Ranges if if the range is very large then the battery can be used. So active tags are for higher read range, semi-active for medium read range and passive tags have a very lower the lowest range.

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Now depending on their capability of how to write on them dependability on the memory they can be either read only tag, right ones and read many times tag or read write tags. And as the name indicates read only tag once they are printed it is printed forever. Then write once read many times tags you get the blank tag and you have the corresponding equipment available with you using which you can actually print.

In the third category is your read write tags in this read write tag you will be capable of writing the information all the time anytime. For example most of the active tags are read write only. Why? They are first of all costly. Just think of the situation you are tracking a

doctor in a hospital doctor if somebody who will not be available all the time in the hospital during his duty hours only he will be coming but he is a very expensive asset of the hospital.

So when the doctor enters possibly this active tag in the form of (())(17:52) like a band or a pen it can be attached to the doctor. So same tag can be re used and when that doctor is relieved of his duty he can return the tag and name of the next doctor can be written on that tag. So such read write tags are expensive and they are mostly used on there for active kind of tags and they are used for asset tracking operation mostly. Then second entity after the tag second entity in RFID system is the RFID reader.

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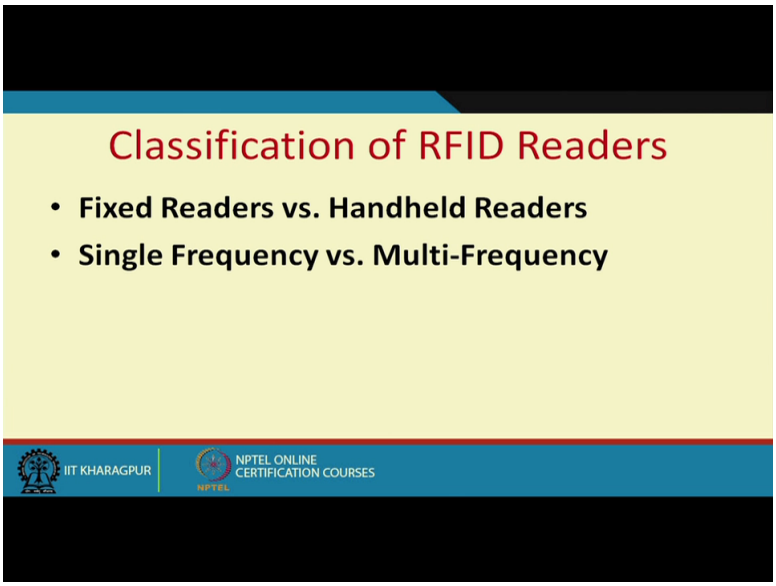

These RFID readers can be either fixed readers or they can be handheld readers. They can operate in a single frequency range or they can operate in multiple frequency ranges. Now when we of course this we are not going to discuss further but placing this readers in right places in your warehouse is extremely important. So that maximum of your tags gets covered.

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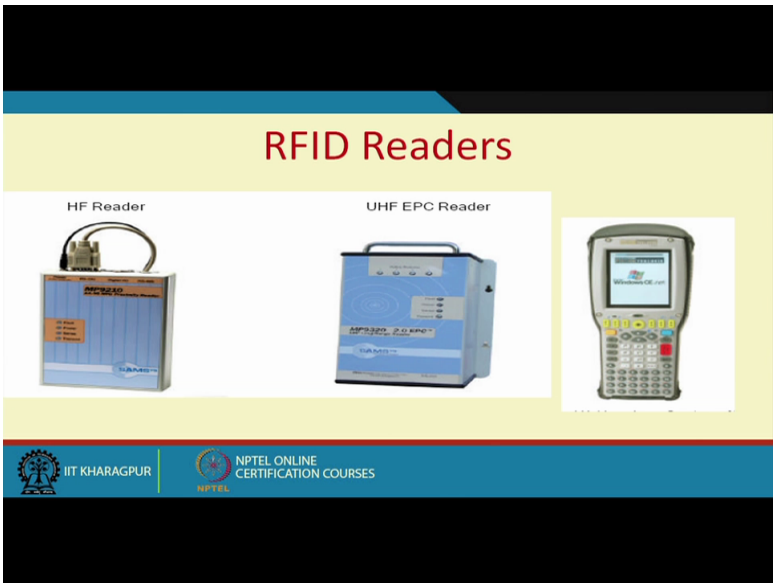

These are some snapshots of readers and two are fixed kind of readers and the last one is your handheld reader.

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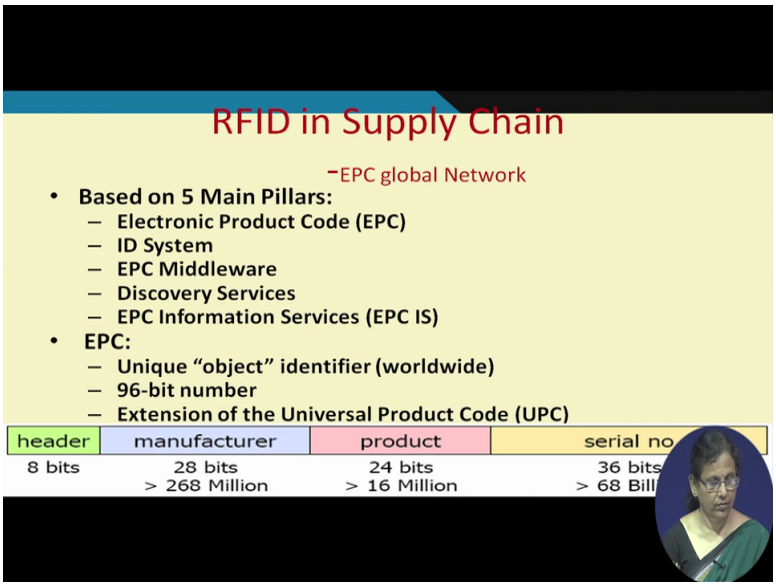

Now RFID as it is cannot really help in automating the supply chain. The automation of supply chain through automatic data capture across the supply chain while a good travels over the m over many over entire chain through many levels can be uniquely identified because of certain infrastructure which is called EPC global network. There are five important elements in this EPC global network.

First one is electronic product code which uniquely identifies one item. Second is there is one ID system for this identifying this uniquely identify keeping the data about the system. Then you have EPC middleware then you have Discovery services which will be relating the code with the data then there is one EPC Information Service which this is the one which actually enables everybody in the supply chain to connect to his data.

And get access to this data. So let us start with this EPC. So EPC which is your electronic product code is an extension of your UPC which is universal product code. Now this this EPC can uniquely identify every object worldwide. It is a 96 bit code where first 8 bit is used for some administrative purpose. Second 28 bit can be used to identify a manufacturer uniquely in the whole world.

So which means around 268 million manufacturers can participate in EPC Global network that's a huge number and each manufacturer can use 24 bits for uniquely identifying a product category which means he can have total 16 million different product category and again it is a very very huge number.

Then again within each product let say that we were talking about the toothpaste. Toothpaste will have a product code but each individual tube will have a serial number. So 36 bits are used for this so total 68 billion toothpaste tubes can be now uniquely identified. So this is quite a provision.

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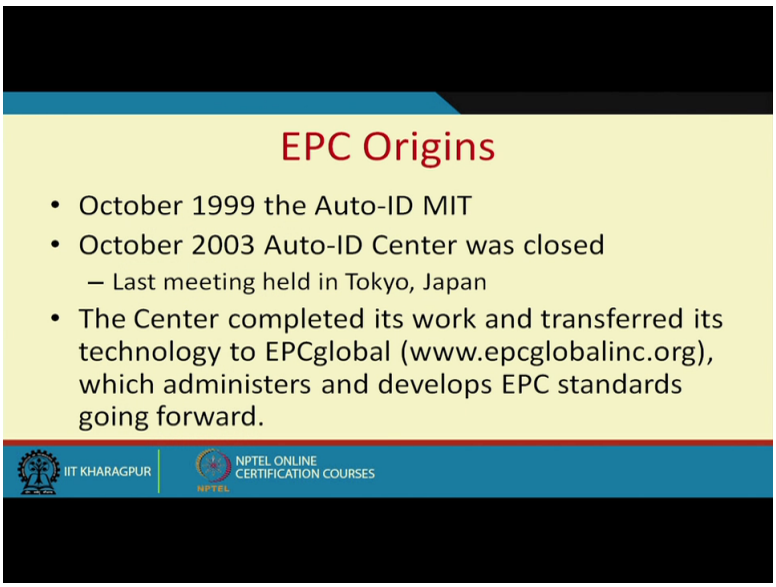

So this EPC this without the EPC the data can be collected tag can be made data can be collected but data will be in your own server. How that data will be shared by everybody in the store by your supply chain partner? To resolve this issue the auto ID centre at MIT they work on this EPC standard and around 2003 this technology was transferred to EPC global.

Right now EPC global is taken over by GS1 and EPC global standard you can learn about EPC global standard by going through this GS1 site.

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Then you have the ID system. In the ID system you have actually the data capture hardware you can say is here. You have the tag which contains the that 96 bit code and you have the EPC reader to read that code. Then you have the EPC middleware which is also called (()) (24:51) as we are going to see. In this EPC global middleware is a kind of filter has many filters in fact to read the data correctly, to identify the data correctly.

Why such a thing is required? Let us try to understand because when you read the tag after all it is some electronic signal there it can be you know it can be lost, it can be distorted and so on. So therefore so therefore you need some kind of mechanism in fact the readers will be reading this tag continuously.

And every time they may not be reading correctly infact the data can also come from multiple readers because readers will be installed in many places of your Store where the items are there and as soon as the tag comes to the magnetic field of the antenna it receives the signal,

it receives the data show data. So data coming from multiple sources data becoming distorted is a phenomenon which cannot be avoided.

So out of the data that is coming in huge frequency because it will keep reading the data the antennas will keep reading data and it will enter the middleware they come in the huge frequency. So its the work of the middleware to see that taking care of the distances, taking care of the data coming from multiple readers it has to figure out what is the right data. Then you have the discovery service.

Now let's try to understand what is the role of Discovery service so look when the data is coming data after all is the tag the in that information content in that 96 bit it is a 96 bit number some bits are for uniquely identifying manufacturer but what is the name of the manufacturer? What is the name of the product?

So this tag data conversion or not conversion, connection id somebody some system has to take the responsibility of that. So your Discovery services for that however if that it has two passes through the supply chain everybody need to know what is the name of the corresponding to a particular code what is the name and all those details everybody need to know.

So that data has to be kept in some Central repository and some facility has to be provided, service has to be provided to access the data this is the work of this information EPC information service.

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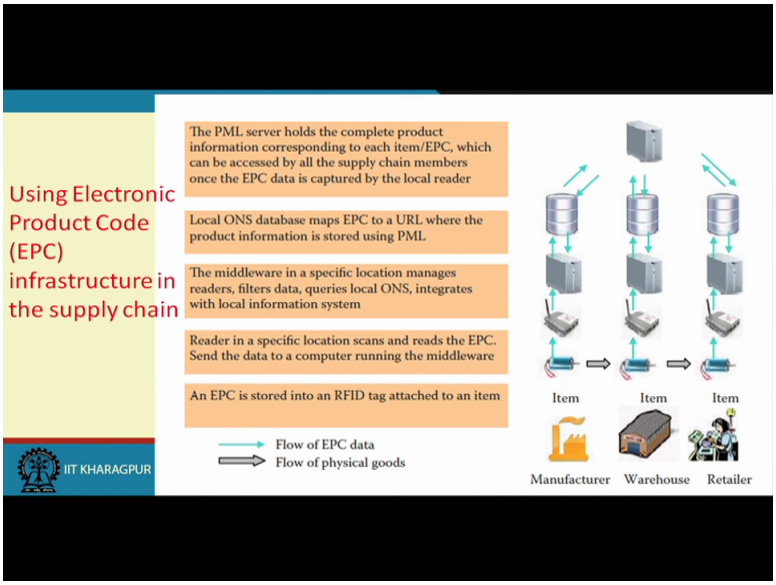

To understand it better this electronic let us try to have little bit more ideas about this electronic EPC infrastructure. Let's say we have 3 entities in the supply chain manufacturer, warehouse and the retailer. The item is generated at the manufacturers end. It is tagged and it is sent to the warehouse. From warehouse it is going to the retailer and from Retailer possibly somebody else will be some customer will be taking the item.

So when the product know in the supply chain along with the tag that the information which is contained within the tag need to be uniquely identified by everybody. Therefore the information within the tag is read by The Reader, it is filtered by your middleware, it is stored in a object named server with maps this code to some to the details of the product associated with the code and this details are stored Somewhere in the Internet.

So this URL which contains the details of the product that mapping that URL with the product ID is done by this server and once that mapping of ID to detail is made and kept in the server the ones item put is coming here its tag is red then from that tag which acts as a Key.

You can find out the colour find out the information corresponding to tell that key and that information can be fetched back and so also at the retailer level. So with this we stop and will continue with our discussion on RFID in the next class. Thank you very much.