Geographic Information Systems
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Module No. #04
Lecture No. #17
Elevation, Relative and Discrete Referencing

Hello namaste h welcome back h to the course on geographic information system, in this particular h module you would be looking at h geographic systems as I spoke in my first lecture, in this particular lecture I would h look at elevation referencing relative referencing and discreet referencing in detail and I would also h this is extremely important when you are actually looking at any of georeferencing system.

So please be careful in understanding each and every aspect of it. I would also suggest h once you have seen this particular lecture please read some of the materials that may be available online h or here there are very good books on GIS, which have also already referred in my first introductory lecture. Please read some of those books, so that you are sure on what you have learnt. So that is exterior this part is very, very important in terms of when you are looking at h to become h GIS expert okay.

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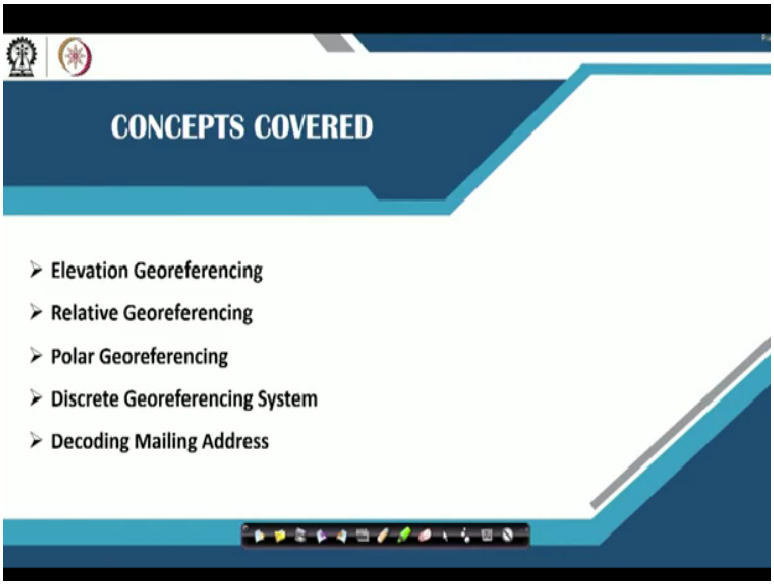

So in today's session we would look at first elevation georeferencing, the relative georeferencing, then we will look at polar, so polar is a continuous kind of georeferencing, then

we would look at discrete georeferencing system, then we would look at decoding the mailing address. So that is also very important in terms of how a particular post or a parcel reaches as without even putting the entire the address may be now in your envelope.

For example if I just say my name with Indian Institute of Kharagpur and 721303, it reaches with me without any hassles. So that means to say that there the entire mailing address has certain way of looking at it.

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So we look at that, so just to go back to the previous , so that we understand it much better, the first we started with what is georeferencing, we have 2 types of georeferencing, we looked at one is continuous georeferencing, other one is the discreet georeferencing, when you look at the continuous system we have relative georeferencing, other one is the direct georeferencing.

When I look at relative georeferencing, we have polar coordinate referencing, whereas we look at the direct georeferencing then we have elevation referencing, datums, coordinate systems and map projections. This is what we look at in the next 2, 3 classes of this particular subject, then we looked at discrete referencing we also said how discrete referencing can be done. So this is what we learnt in our first lecture on this particular topic.

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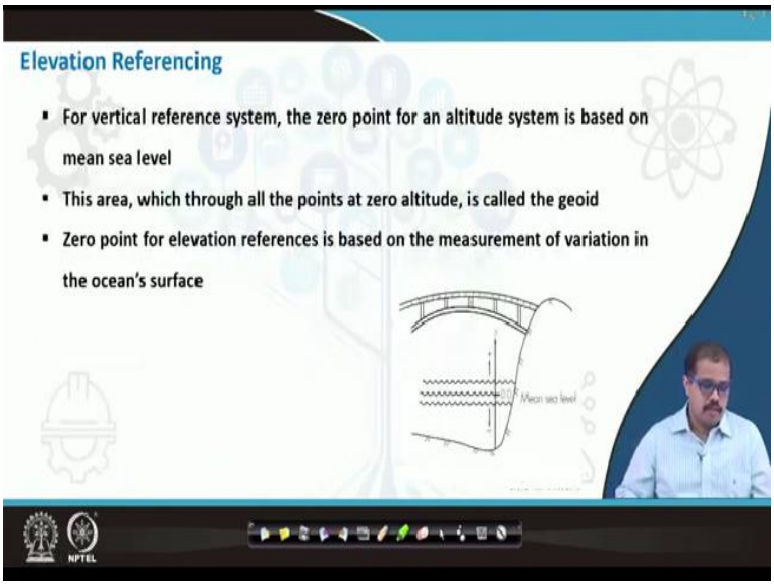

Now let us go into each and every of the kind of this referencing and look at why it is important and how do we look at it. The first kind of referencing is elevation referencing. So for when we always consider any of the vertical referencing system the zero point from altitude system is based on the mean sea level. So, when I say mean sea level, you have zero as the reference point. That is mean sea level is zero altitude.

So based on that you will start to look at the vertical space, so that means this mean sea level is always a referencing point. So this area which through all the points at a zero altitude is called as a geoid okay, please keep this in mind, this particular area which through all the points of this zero altitude of the earth's surface is called as geoid, geoid d is nothing but a zero altitude. We can even look at geoid in a better way.

I will go and I will explain to you in the next slide, zero point for elevation references is based on measurement of variations in the oceanic surface. So that you should keep in mind, so it is not just about saying that this is the mean sea level but we have to look at every references in terms of the oceanic surface and based on that the relatively look at this zero point okay.

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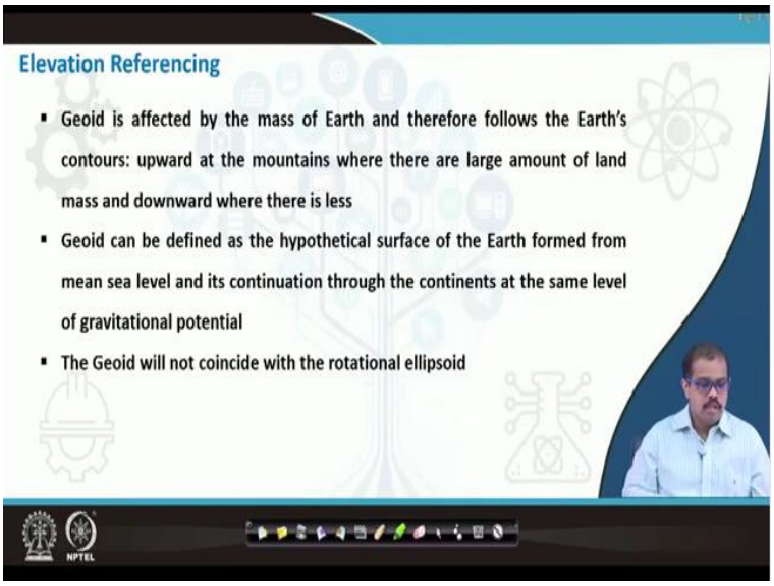

So geo when I come to the geoid, geoid is affected by mass of earth. So, there are lot of variations that you can see, the geoid that they are measuring at one place to geoid that we are measuring on the other place okay , or the mean sea level zero mean sea level that we are measuring on one size and zero mean sea level that you are measuring on the other place. So geoid is affected by the mass of earth and therefore follows the earth contours.

I spoke about what is a contour in my previous class, so it follows the earth contours upward at the mountains okay. So the way the contours flow the upward direct it also flows upward at the mountain where there is large amount of landmarks and downward where there is less landmarks okay. So we have to understand this very clearly. So, it is the way the earth contours move if it is a mountain it moves like this.

Then suddenly if there is system where you have lower references or you have a downward trend in the earth's surface it moves like this, that is nothing but a geoid. Geoid can be also defined. So it was normally geoid is you are thinking okay, geoid can be defined as an very hypothetical surface, which an hypothetical surface of the earth that is actually form from the mean sea level and is in the continuation to the continents at the same level of the gravitational potential.

So now you should understand that the gravitational potential also is involved in terms of defining the geoid okay. So it is a continuous as the earth's surface follows the contours in and

represents entire mean sea level, but maintains the same level of the gravitational force. So, look at the every aspect of it and one thing that you should remember is that geoid will never coincide with the rotational ellipsoid okay. So, if otherwise it is not called a geoid okay.

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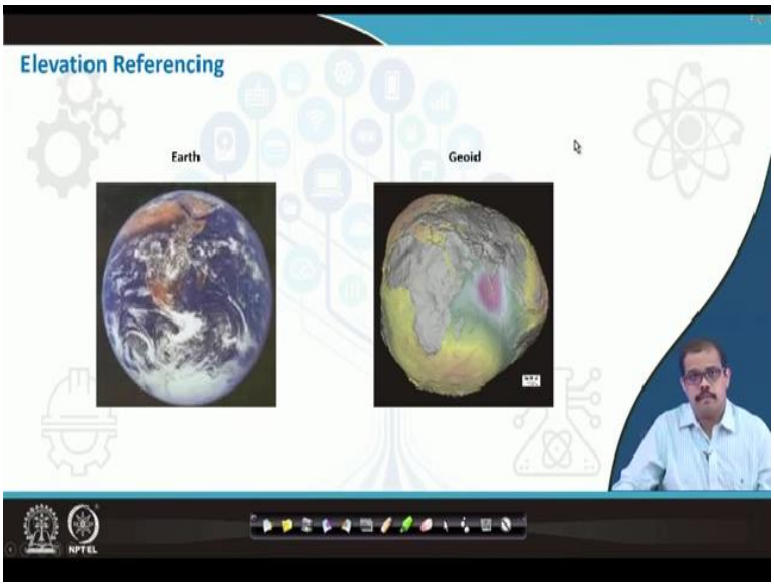

So, to give you an example of a geoid on your right-hand side image that is from one of the sources here that mention you can see this is a geoid of the earth surface okay, you can see here is the earth's surface it is a spheroid, so geoid is something like this okay. So you can see wherever there are higher landmarks you can see this okay, where there is actually it is going down you could see some changes here okay. So, it is where you have zero mean sea level. So, this is the first concept that you have to understand.

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Then the second one is relative georeferencing. So relative georeferencing is also a continuous georeferencing when you look at relative georeferencing it includes polar coordinates, offset distance, measurement along a road network. So I will get into each of these aspects in my next slides.

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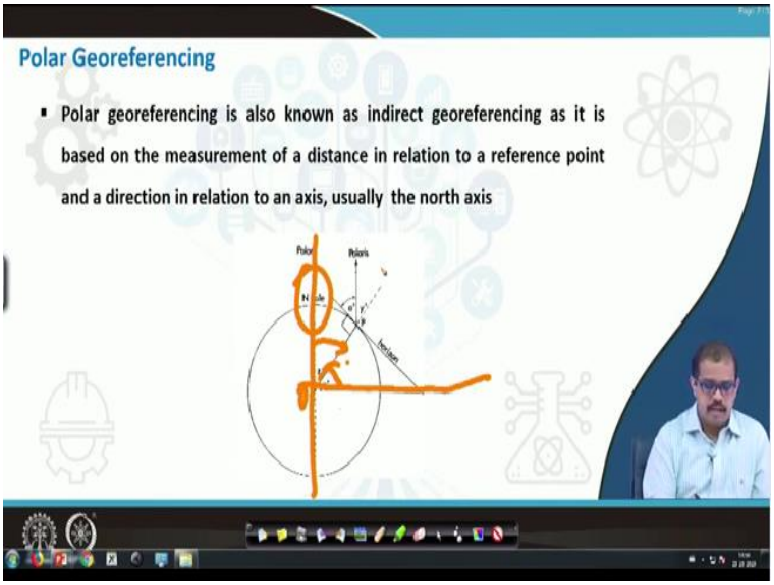

The first aspect is polar georeferencing, it is also called as an indirect georeferencing, I spoke about polar in my previous class. So it is basically an indirect georeferencing, what we do is that we consider we do the measurements of a distance in relation to a reference point and the direction in relation to an axis that is usually not axis. If we look at this particular image okay, if we look this is if we have consider this is a north pole okay, if that is north pole that you have

consider, and this is the polar is okay with hope.

Now if we have to measure a particular point here with reference to this what is a distance that with reference to this what is the angle that it is making if you have an imaginary line. So, what is the angle that it is making is calculated that is nothing but a polar georeferencing. That is how you refer, at this point on the earth's surface with respect to the north direction lie somewhere here okay. So that is how you do a polar georeferencing okay.

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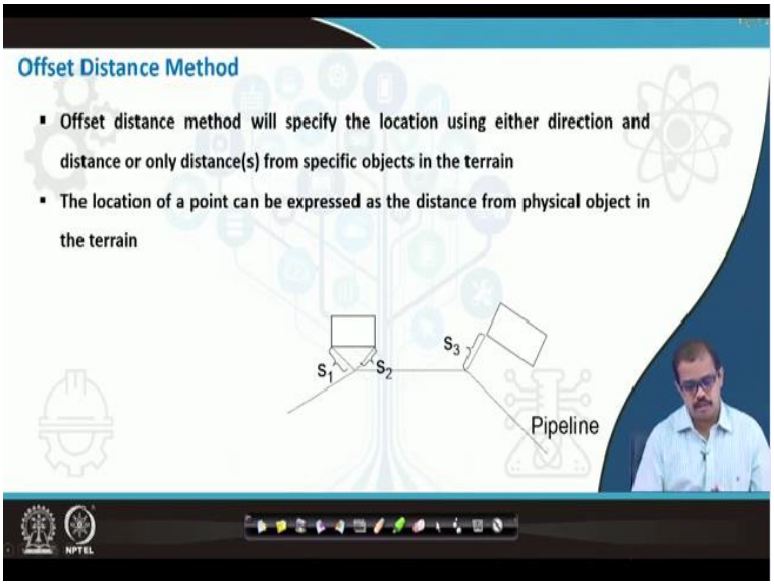

Now thing is offset distance. So, this is also a I mean a kind of a continuous georeferencing where offset distance methods will specify the location with either direction and the distance or or only distances from a specific object on the terrain. So if for example if you are looking at a pipeline okay. Now, these are the objects on the earth's surface okay.

Now you this offset distance method will specify the location of this particular pipeline based on these objects on the earth's surface okay, without which will not be able you will be able to get a particular location, location of a point can be expressed as distance from physical object in a terrain, which is always a distance if many of times it is only distances that is mentioned.

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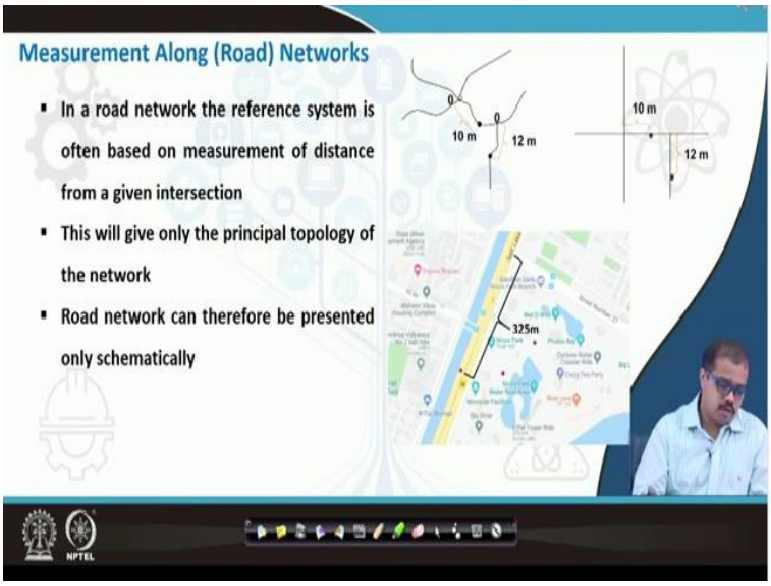

But, in case there are certain systems where you can even look at even the directions, then you have road network, but this particular kind of measurement is actually an approximate way of looking at your referencing. So when you are looking at the road network the referencing system is often based on measurement of a distance from a given intersection, so keep this in mind, you are always measuring from an intersection.

This this will give only the principal topology of a particular network, but it does not really give you the direction and the displacement in that particular network okay. Road network can therefore represented only schematically okay, it can only be a presented schematically one example is shown on the right-hand side, which is actually representing one of the very prominent regions in Kolkata okay.

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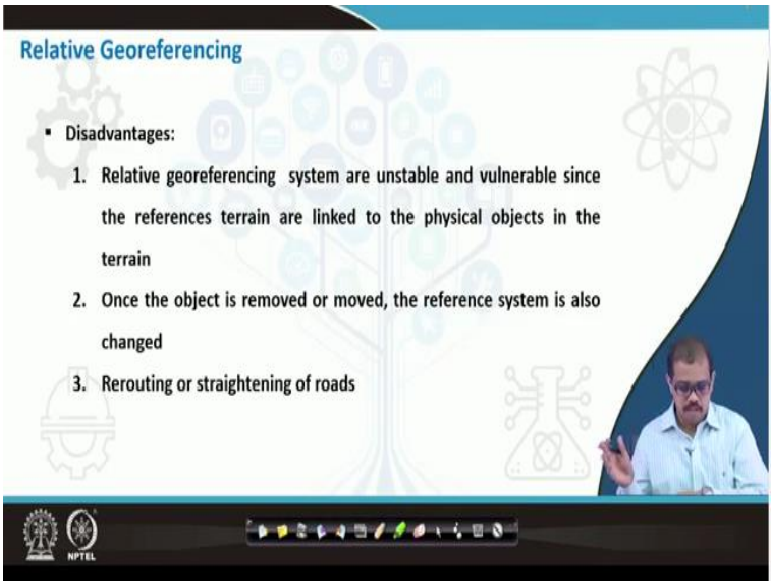

The third then the when we look at relative georeferencing there are huge amount, huge number of disadvantages, some of them when we is quite unstable and we look at relative georeferencing is quite unstable and vulnerable since the reference terrain are linked to the physical objects. So, whether it is road, whether it is objects on the earth surface, that we are trying to look at. So, these physical objects are linked when you are looking at distance and direction the physical objects are taken into consideration which actually if there is a change in this physical object.

Then your direction and your dimension changes on your earth surface. Once object is removed or moved the referencing system also change. So, that what I meant, then rerouting a straightening of roads if a certain things happens like that then the way you have georeferencing your old map may not fit into the new map.

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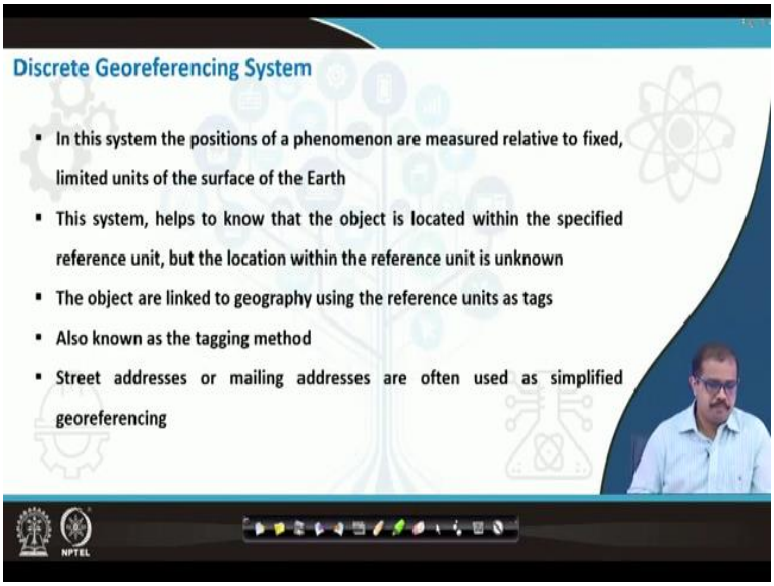

So then as a discrete in a discrete georeferencing system. In the system the positions of phenomena measured relative to fixed limited units of the surface of the earth okay, please be careful in this way. In the system the positions of phenomena okay, is are measured relative to fixed, you are relatively measuring okay, limited units of the earth surface of the earth. The system helps us to know the object is located within the specified reference unit but when you are looking at the location within the reference unit it is unknown.

This is what is the problem of a discrete referencing. So it helps you to locate an object within a specified reference unit. But, if the location within the reference unit is quite unknown, if you are taking this, there is one building let say one parcel as a reference unit within that reference unit the whatever position is unknown, but with reference to that reference unit around the positions is quite known. So that is one disadvantage of this particular system.

Then the object are linked to geography using reference units called as tags. So that is what , I meant the tags, tags or units is nothing but the discrete referencing system is also called as a tagging method, discrete referencing system discrete method or a tagging method. Street addresses or mailing addresses are often used as simplified georeferencing systems. So this is the best and easiest way of georeferencing. So everyone at every look and corner can understand this kind of georeferencing.

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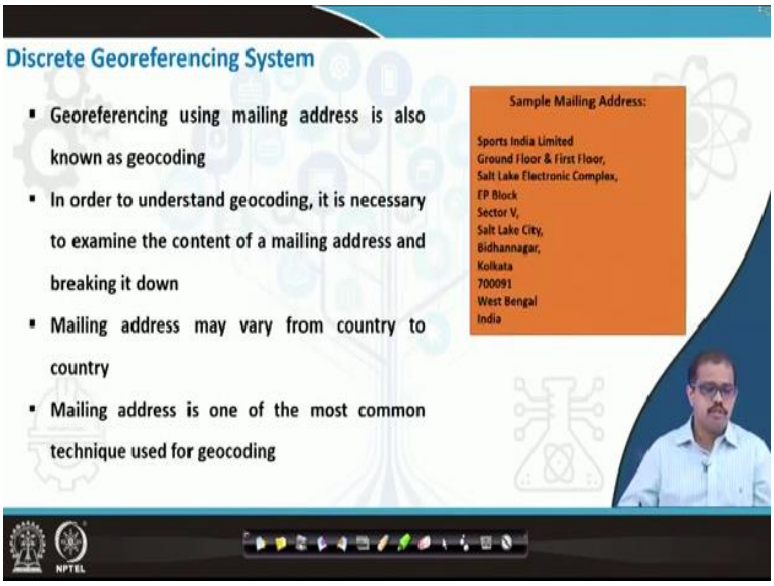

So when you look at discrete georeferencing, for example, if you have georeferencing your mailing address is also called as a geocoding, your coding your point on the earth's surface using a mailing address. So it is called geocoding okay. For example if I have something like this there is a sample mailing address, that is shown here , when you see this a sample mailing address Sports India limited you have a ground floor okay.

This is all that attribute information that you have, but when you look at salt lake electronic complex, that is where a particular position there, but what that is actually referring is it is in 740s 700091, so which means that it is in Kolkata in Bidhannagar in a salt lake city. So that is already now it is giving you pinpointing you to a particular location a small area in Kolkata. So once you have known that particular and it says this particular pin code belongs to sector 5.

So now you know where sector 5. So, now it is much more smaller region. Now, just with the block information and then the name of that particular building, you know where you have to deliver your post or your parcel. So that is what, that is nothing but a geocoding okay. So mailing address may vary from country to country, always it varies okay. So, mailing addresses is one of the most common technique for using a geocoding issues okay.

So, please remember this whenever we have to use any kind of georeferencing in times of discrete georeferencing most of the best methods we are used as in the form of a geocoding and

the use nothing but a mailing system.

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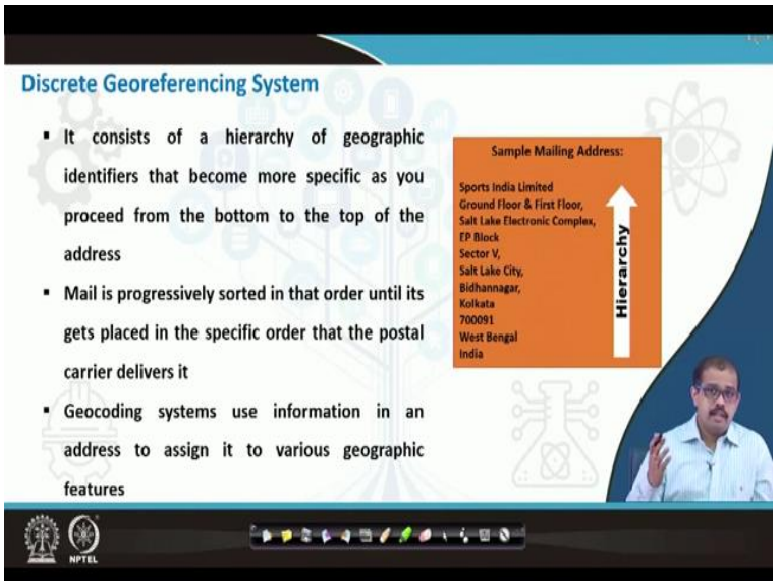

Then, when we look at this kind of system it is a hierarchy of geography identifiers that become more specific as you proceed from bottom to top of the address list okay. For example, when I am looking at here the first thing that anywhere, for example, there is a parcel that is actually coming from may be some part of Switzerland to India okay. So now the first thing is India okay. So now that then 700091. So now you are actually digging information from country to region.

Now, with the region you know which city right which city and which place in that particular city with another place. So now in that Bidhannagar okay Bidhannagar area so you have a salt lake city. So salt lake city is then look that then it is sector 5 okay, this particular pin code belongs to sector 5, so that is the first thing and then the digging will happen with the block, the EB block it belongs to EB block.

So then is your sports India limited, so that is what is called as a hierarchy, always it discrete referencing system, in terms of hierarchy. So, it proceed from bottom to top of the address, so the first addresses looked at from the bottom, then mail is progressively sorted in that order until it gets placed in a specific order that the postal carrier delivers it okay, so when we look at geocoding systems use information in madras to assign it to various geography features.

So please be careful, we are assigning it to various geography features that is how mailing address will become into a geographical address okay.

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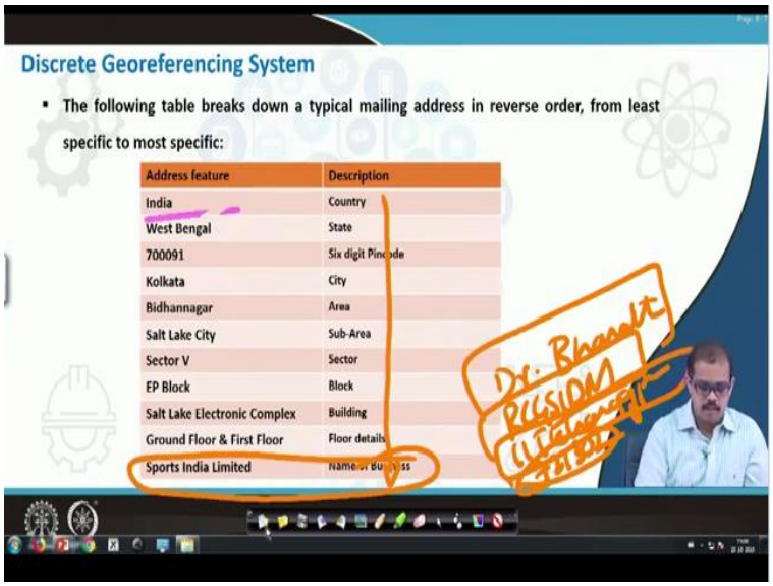

So when we look at one example here we have a typical mailing address in reverse order. So, from the least specific to the most specific that gives you the hierarchy, how it actually follows. For example, when I am considering there is here the first thing as that we normally see this, India and the country right. So, once we have seen that, then the next point. as we look at it is in the state of West Bengal right.

So then we look at the 6 digit pin code. Then is the city, then is the area, then as a sub area that is a salt lake city then we look at the sector, then at block, then look at the building and then the floor name. So now we are indirectly actually looking at different hierarchies here. So if you look at the final thing is the name of the region. So, for example, if you are trying to mail me if is if this is my mailing address.

For example if I we just write this okay, IIT Kharagpur and 721303 302. So the first thing that we see here are 721302. Then the IIT Kharagpur as the location where it has to reach then, is the department, then is the person's name where it has to be delivered. So that is how this discrete referencing system works okay.

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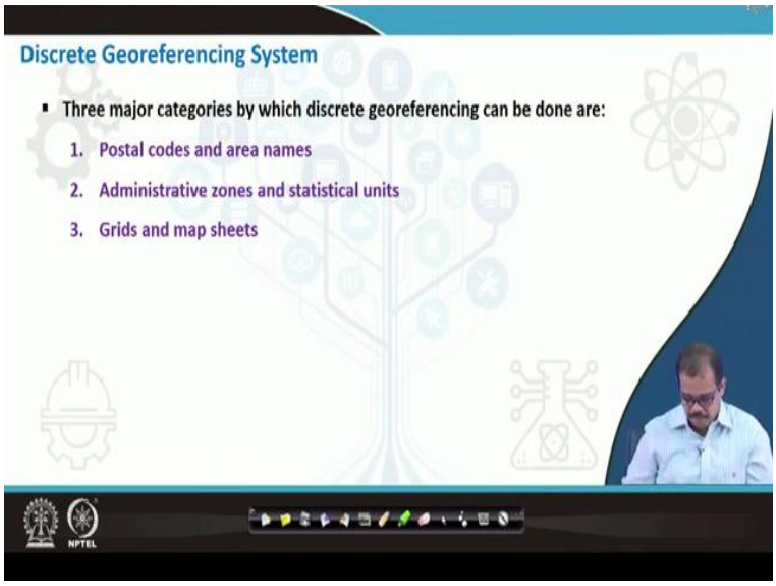

Now, 3 major categories by which they are discrete referencing system can be done as one of the postal code and area names that have explained in my previous slide, even you can look at this discrete reference in this administrative zones and statistical unit. Normally, in terms of if you see the government gazette will find out on this, the grids in the map sheet. This will learn when we are looking at what is a map and what are the different qualities, quantities in a map okay.

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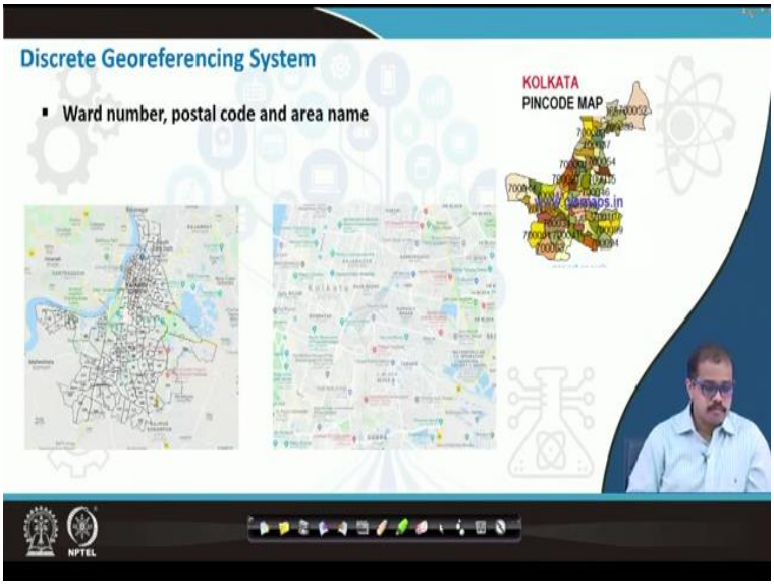

So when we look at discrete referencing system it is , if you see this what number postal code and area name, these are certain examples, for example I have shown here the entire Kolkata city okay, when you look at the entire Kolkata city here you can see that these are the ones, there are 7005227006394 all of these are the representation of the pin code of that particular city. Now, we

have what is different, what is in the entire city.

If you see here the number of the that what number also represents a particular geocoding of that particular base, then you have postal codes I have spoke and these area names for example, Tanagra, Gogra and you have Raja Bazar. So these are the source salt lake area. So, all of these are nothing but a geocoding into your map. So you are giving a referencing way. So that referencing way may be understood by many.

If I say salt lake city in Kolkata, many of them will understand this particular place is somewhere here okay. So, if I say there is an BC block or may be a CD block or EF block. So, they will understand in a salt lake city there are certain blocks EF blocks can be reached by this point, that is nothing but your coding the earth information or information about objects in terms of the area name and or you can even say it as ward name, ward name is not easily seen .

For example, no one can understand that if you say that I am I belong to ward number100 okay because it is extremely difficult to remember if there is a city has 198 or 200, or 500 wards. So, it is extremely difficult for them to understand, or remember all of these names instead, it is much easier to remember, in terms of the area names okay. So, yeah that is that is about looking at the discrete referencing system.

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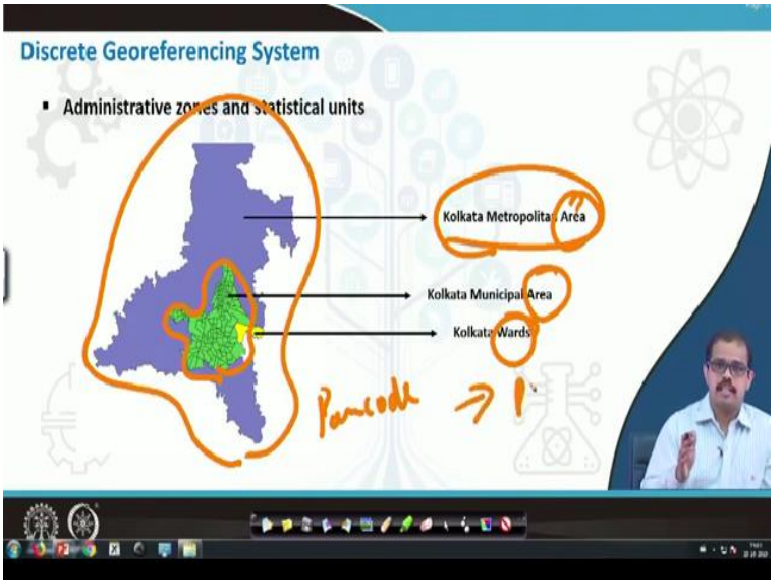

So, the next thing that we would also look at here is okay, this example of an administrative zones and statistical unit, that is also discrete referencing system. So, now for example there are there are 2 images that you can see here, 1 image is in the form of your boundary here in the purple colour. So, this particular boundary is representing a Kolkata metropolitan area. So now I am giving area referencing here.

And if I see this, this is an Kolkata municipal area again an area referencing. Now in that I have number of wards, so this is wards referencing and each ward has a code okay, so each pin code is nothing but again a pin code referencing. So this is nothing but a discrete. I have just given several of examples so that everyone understand how geocoding is normally done in terms of using a GIS.

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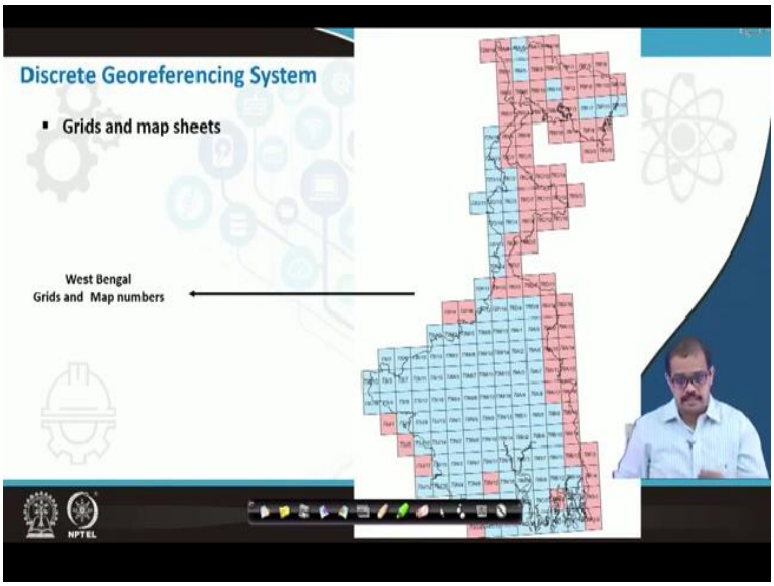

So, these all for the grids and maps, you can see there are number of grids here, I will also tell you how this grids are located, what are different ways and what is for example if there are 79A/4 what it actually represents in what kind of units it represents, and the what is the amount of information that it stores about the earth's surface in this particular, I will take this up when I am explaining the map system and the AC systems in my next class,

okay.

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So when we look at this the first thing that we look that is we have elevation georeferencing which is called as geoids, we have relative georeferencing wherein offset measurement along the road we looked at. So, most importantly , please remember that geoids are the representation of the earth's surface on the mean sea level. Otherwise, you can just say that the mean sea level is represented as a geoids.

But maintaining the same gravitational potential across all continents or across the entire plan surface of the earth. So that is nothing but a geoid and when you look at polar georeferencing we did see, we take a reference normally a north pole as a reference, then we calculate what is the distance from the north pole or the directions from the north pole with an angle. So that is called as a polar georeferencing.

Then we look that different direct discrete georeferencing system and the importantly the mailing address and if we look at the mailing address we understood it as more of a hierarchal based approach, when I say hierarchal base approach it starts from the bottom of the table and goes up to the top of the table okay. So when we are actually look at the entire mailing address.

For example, if you look at any of the mailing address for the entire region of the land surface or the globe. So, it is extremely discrete for that particular region. So you would not have the same mailing address to any part of the earth surface, then that is why it is called the discrete system

and there is only one assigned code for a particular thing okay.

So if you want to try , how discrete and how it can be easily accessed , I would suggest you write a particular postal form and maybe you can post it with just your name and your pin code. So, that post will actually come back to you because you have mentioned the pin code and your name. So if you are a well-known person in that particular character postman knows you, it is easier okay for them to locate you.

But other information in case they do not know you, they may need your area under the signatures in your postal code. So now in the next session the next part of what has to be understood that the coordinate system. So now we have understood what is the geoids we look that elevation referencing, next is the coordinate referencing. So once we have understood how the earth's surfaces, what is a different system of the earth surface that is a geoid.

Now we move into the next part wherein we look at the coordinate, once we look at the coordinate which mean you are plugging in the entire system onto the earth surface then we look at the projections, so we will be bring the 3D map to the 2 D surface we already know how we are plugged in so put it tie it on to the earth surface. So that is how you tie the entire 3D surface to the 2D map.

So in the next class we look at the coordinate systems, how to apply, how to use it, and what are the different ways of looking at it, okay. Thank you very much, let us meet in the next class.