Remote Sensing and GIS for Rural Development
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Centre for Technology Alternatives for Rural Areas (CTARA)
Indian Institute of Technology, Bombay
Week - 11
Lecture no 04
RS and OSM for Mapping Rural Infrastructures: Hospitals

Hello everyone, welcome to the NPTEL course on remote sensing and GIS for rural development. This is week 11 lecture 4. In this week series, we have been looking at the concept of synergized mapping for creating multiple data sources with remote sensing data for an updated rural data management.

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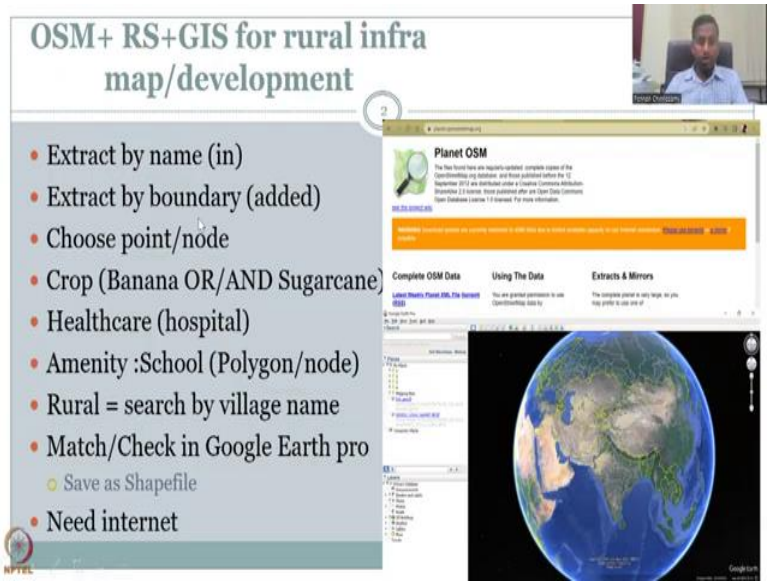

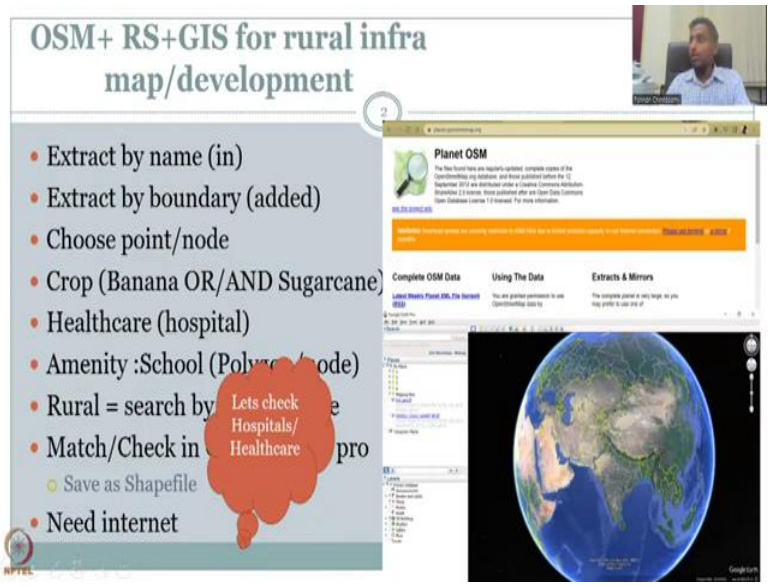

In the last lecture, we have looked at using OSM data and remote sensing data on GIS platform which is QGIS for rural infrastructure mapping, especially schools. In today's lecture we will start with hospitals and also try to map some more aspects of hospitals which are road connectivity and other aspects. So, will go through the same steps we will extract by name start by boundary which we did in the last time since it is going to be hospitals it will be much lesser than the current setting.

So, I will use a smaller state for an example we will set the state and make a layer out of it. We have yet to do the cropping, but I can quickly show the cropping along with hospitals or roads. And then we can also search by a village name as I said lonely village for example. So, then we have looked at how to check in google earth pro. And then, as I indicated there is not enough internet. So, without further ado, I am going to do the hospital's this today thing and healthcare. So, let me share the screen for your QGIS.

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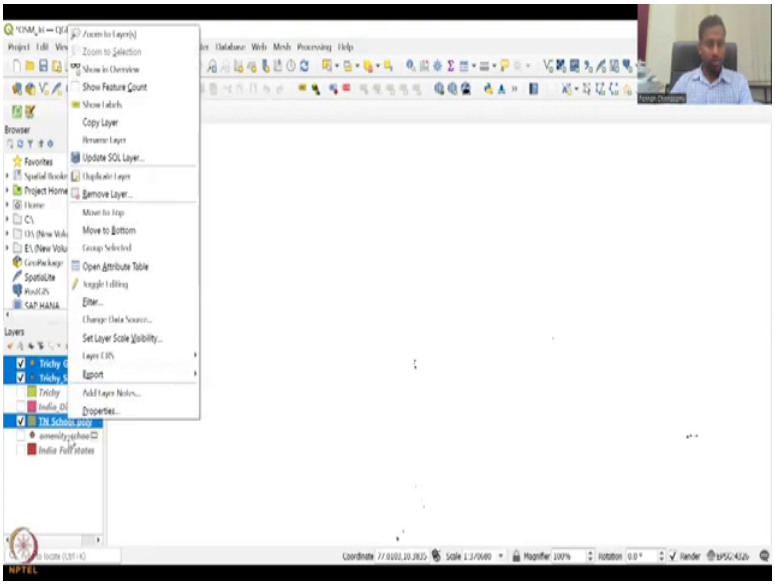

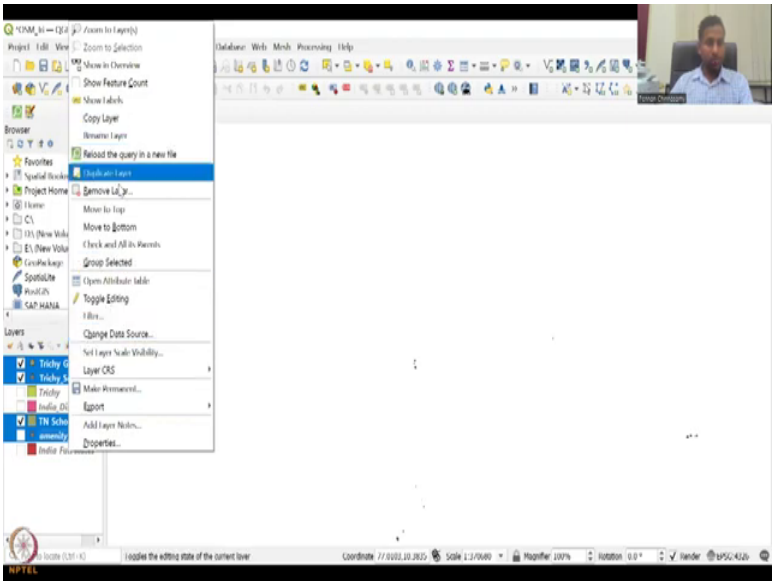
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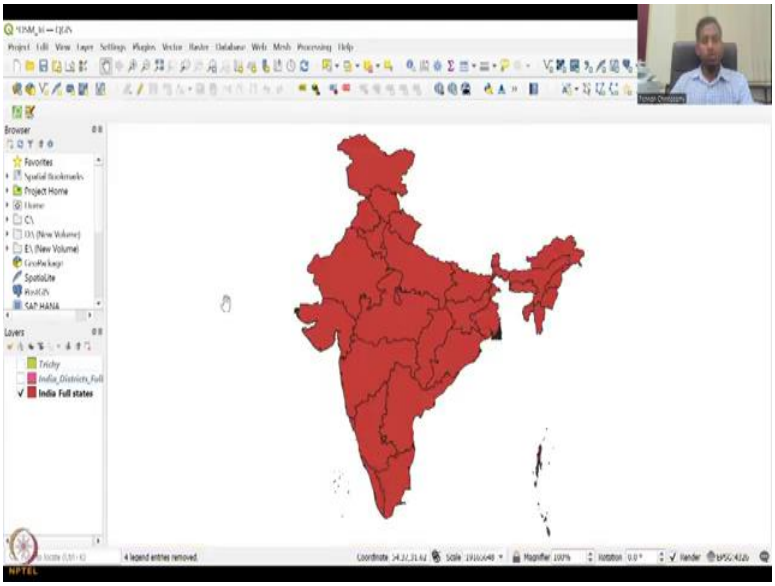
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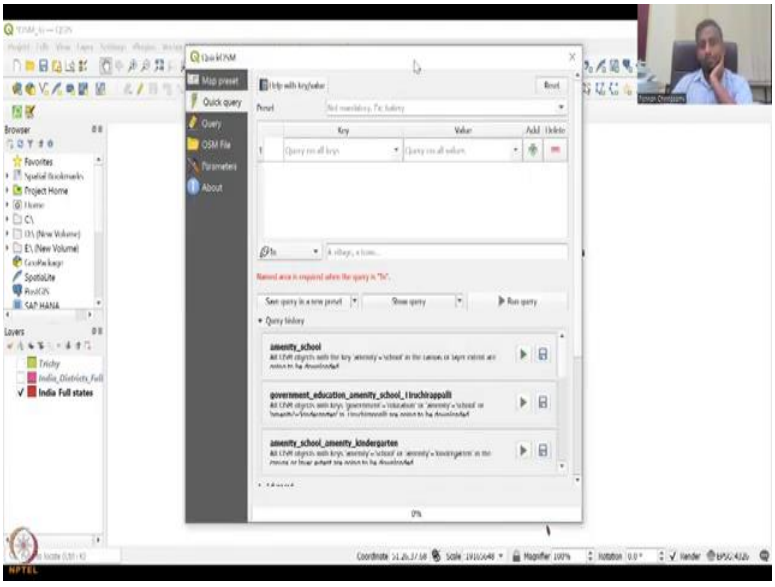
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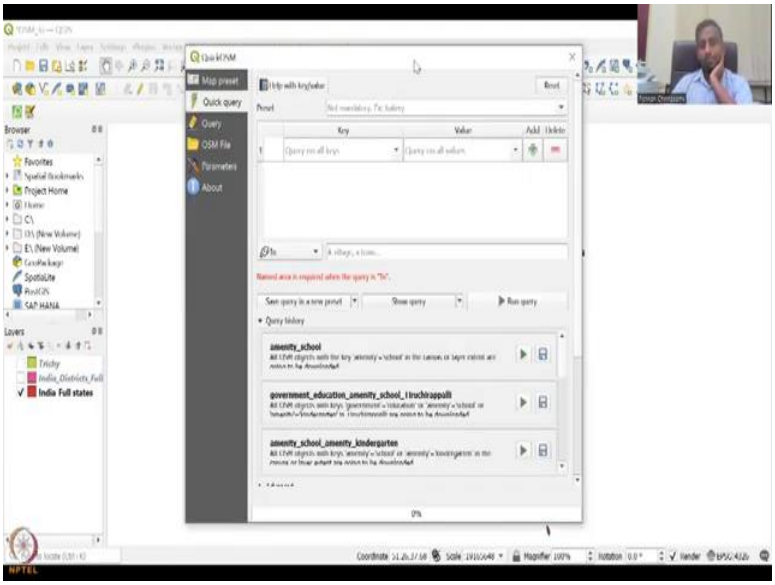
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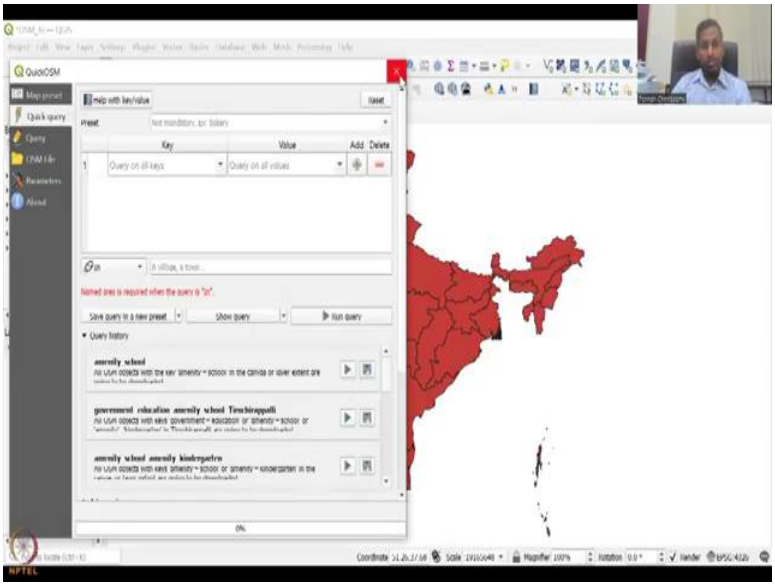
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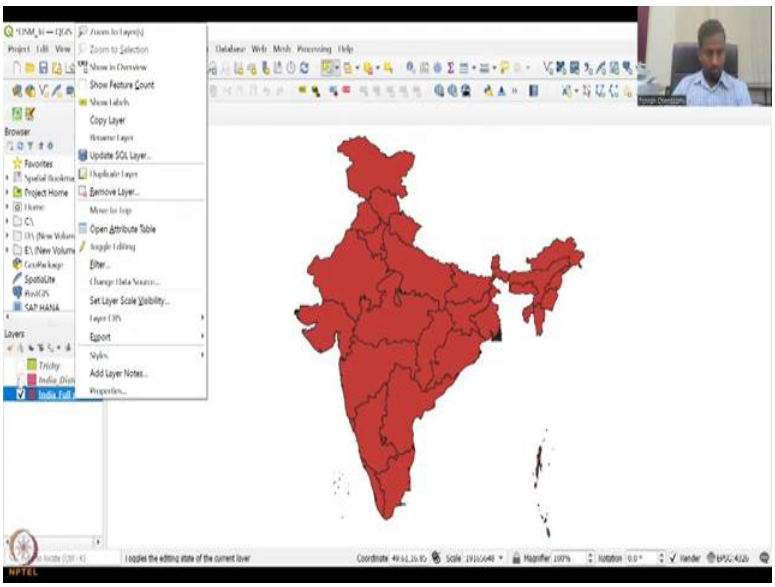
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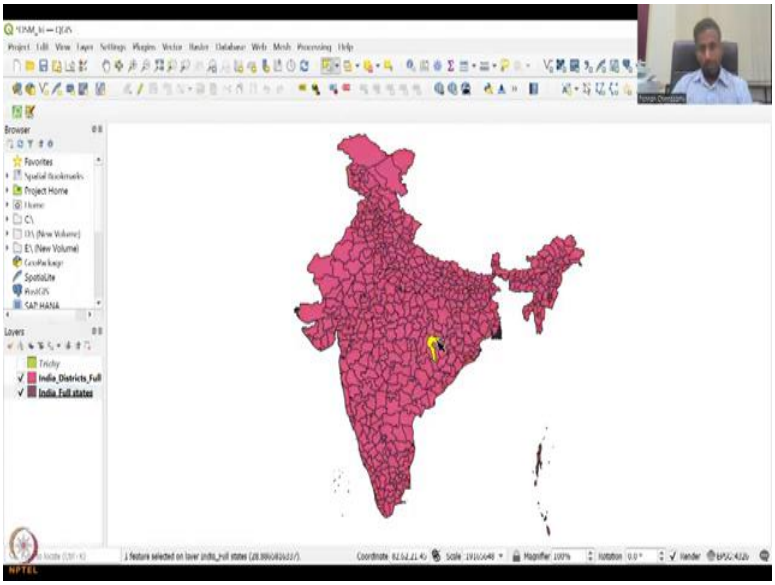
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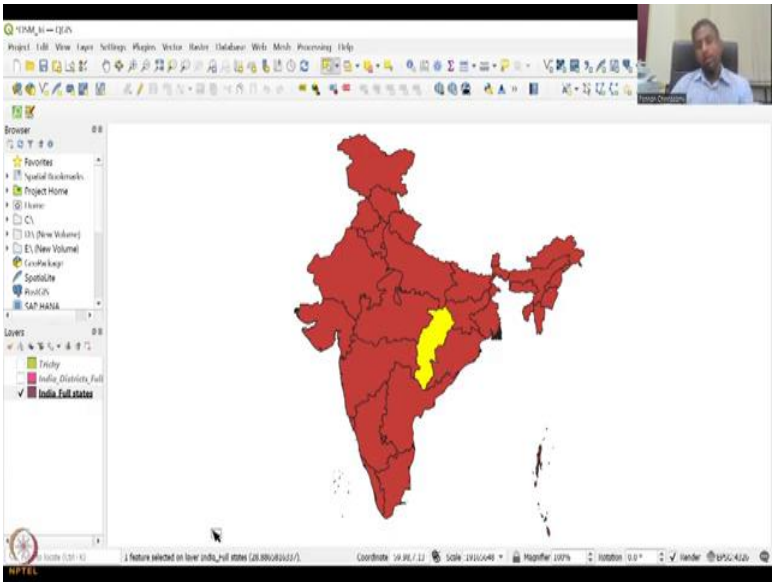
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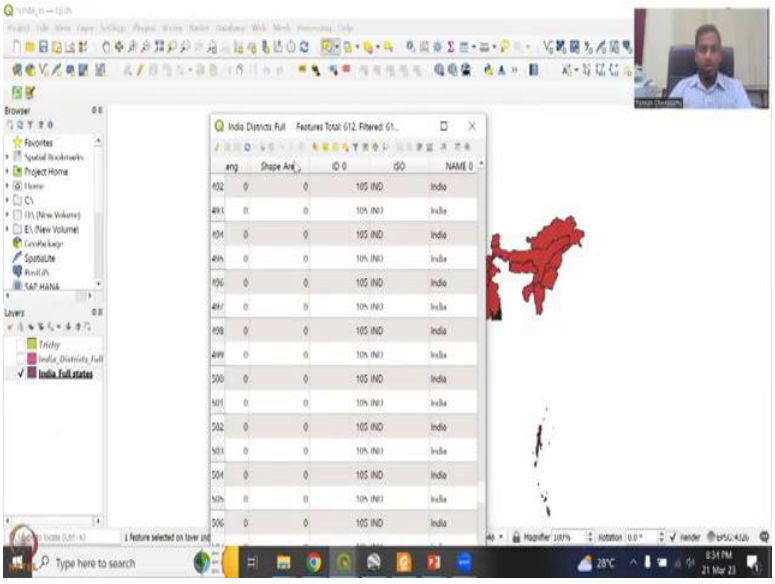
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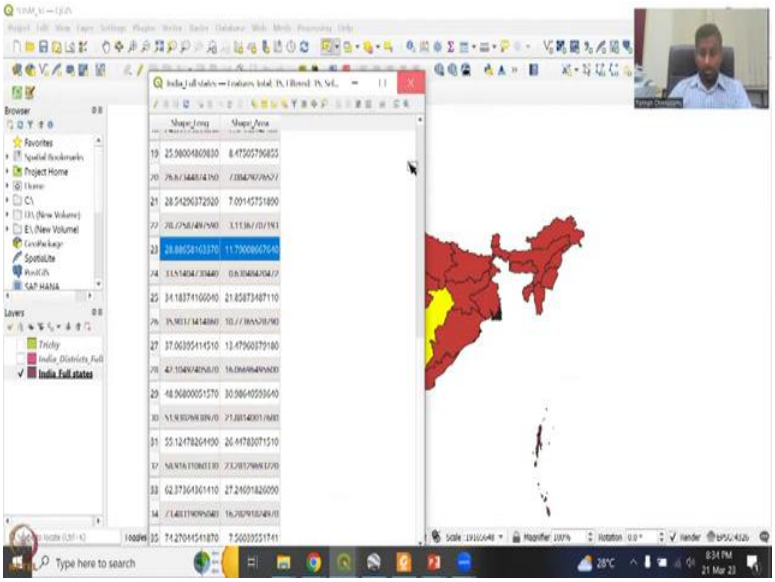

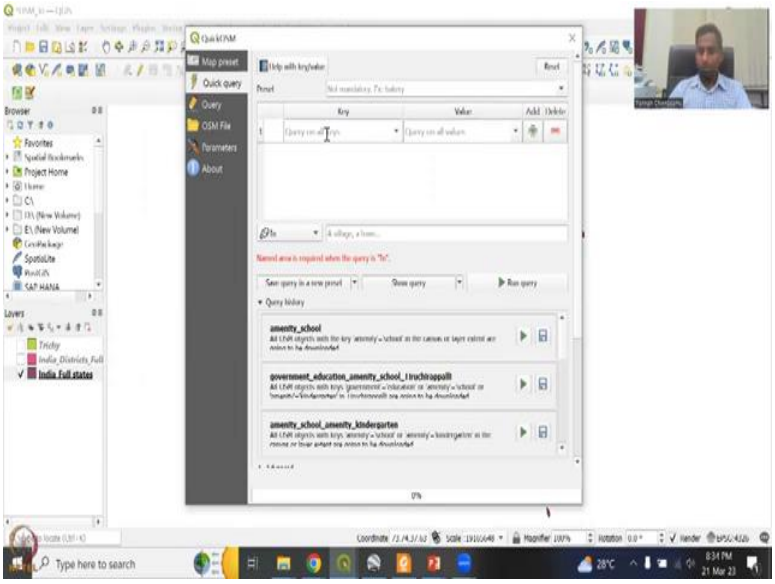
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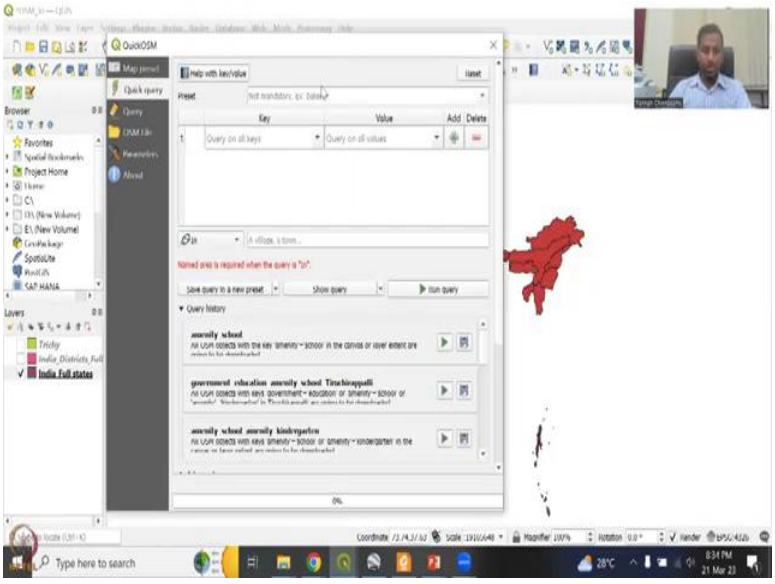
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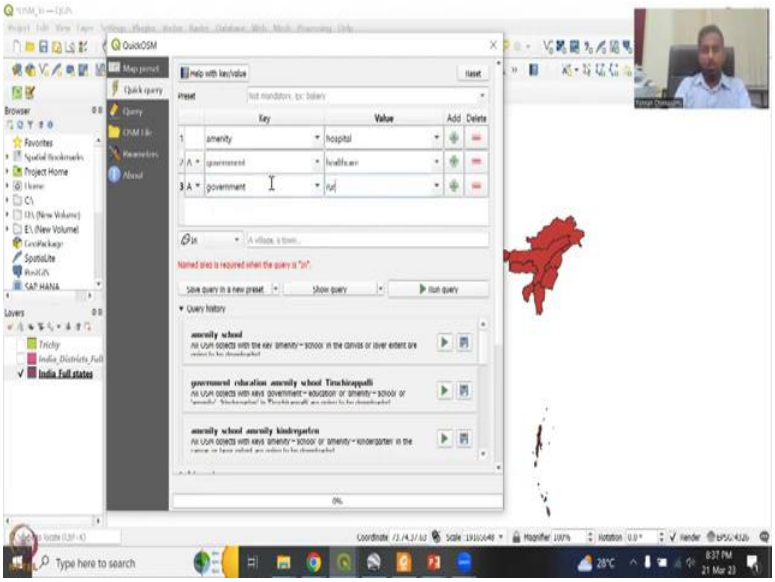
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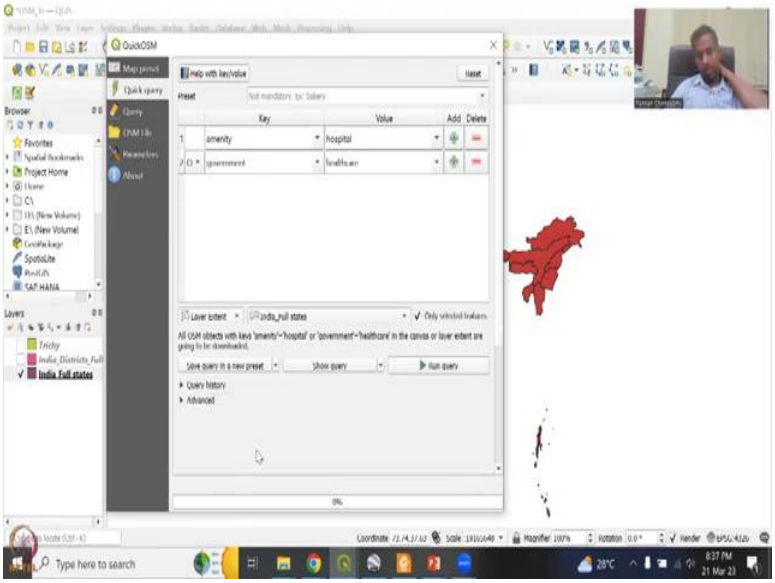
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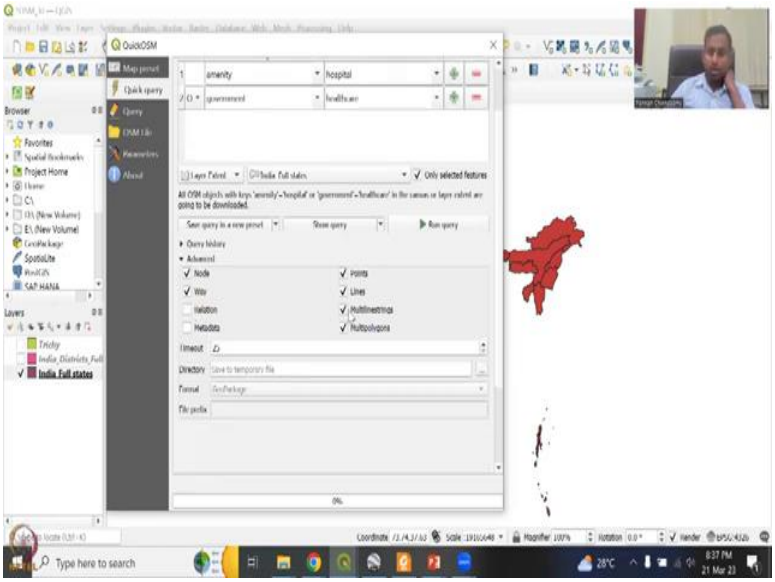
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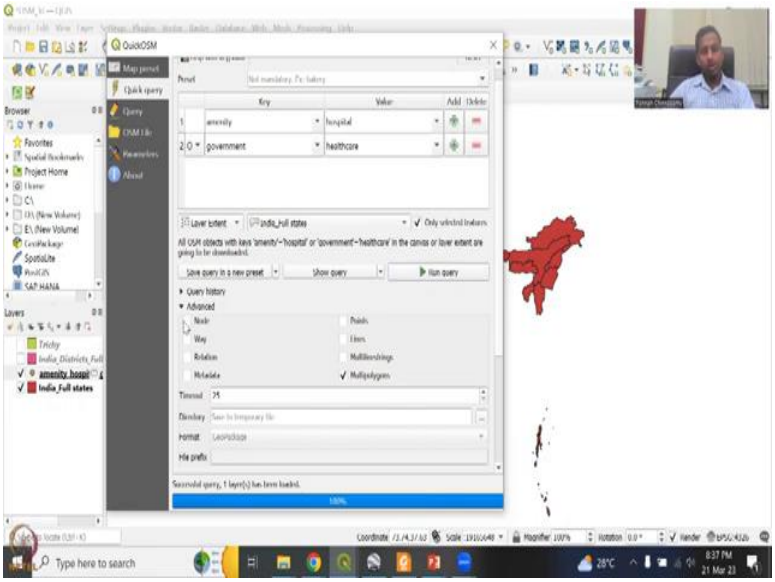
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government
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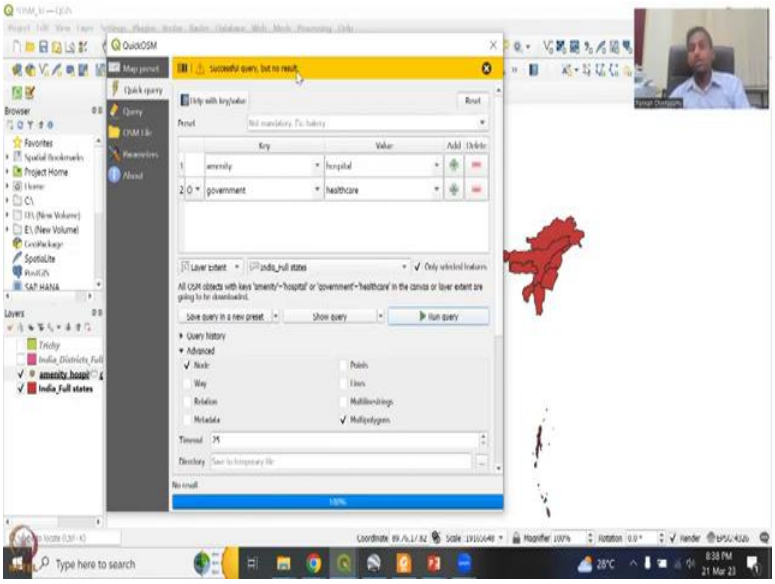
Run query
Type here to search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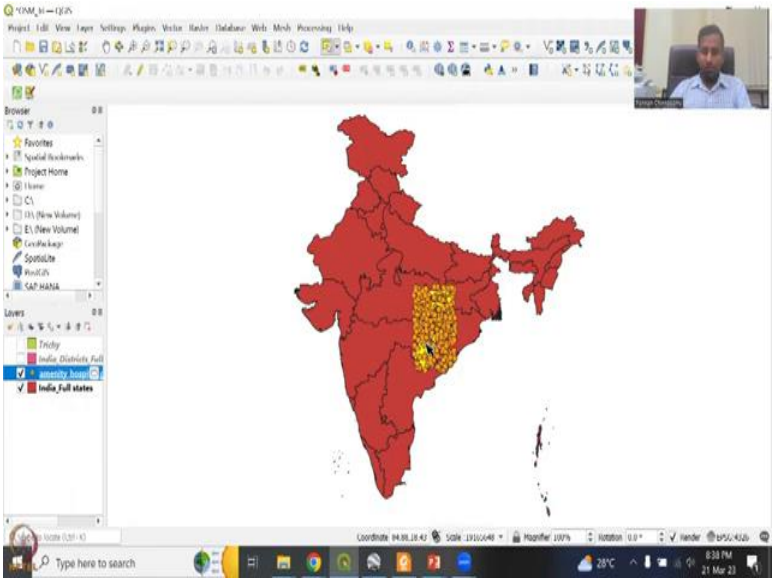
Run query
Type here to search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So, we can remove these from the previous exercise because Trichy, let us keep Trichy in, but we can remove the school's database and the amenities database. Let us remove them for now. And then keep the state's zoom out, we have the 6. And as I said, they keep on updating. So, for now, today, we are going to look at the hospitals. And as I said we could pick Chhattisgarh, which is a smaller state to quickly download the data and use it.

I have using an older map so that we have long time series for example Andra Pradesh and Telangana was already divided now but we will be using this map because for the long time series, Telangana was not there a couple of years ago so we use this data set so that we can have all of Andhra together then we can differentiate it on a new shape file. So, let us start with identification of schools as needed will go to the vector QSM. Click on the QSM toolbar it will populate we can say Chhattisgarh or we will select the layer first.

So, just let us minimize it and then quickly select the Chhattisgarh for us. So, for some reason, it is reselecting all of layers. And then this Chhattisgarh because initially the districts was selected now Chhattisgarh is selected. What we can do is keep it selected we do not need to make a shape file we will do that in the QGIS platform itself. So, now I am going let me share the full screen so that you will see my full pointer, this is the attribute table for the districts when I close it.

So, it will see that in the attribute table of the state's Chhattisgarh has been selected. Now we will go back to vector QSM. So, now we see it. We will not be using the presets because presets have been kind of not capturing the entire aspect. So, let us say amenity first because all amenities can come and I am going to take hospitals. If you just start clicking it will come or I would normally good to read all the list so that we know what data is available, for example, rural development, we need to know how about the animal boarding breeding centers shelters, banks, rural banks are very important for rural development, you can map it.

And I would say this is the most comprehensive data set available, because it is coming down up not bottom down. It comes from down up, child care, you do not find it in rural regions, but you can find in urban regions, then you have colleges, driving schools internet cafes nursing homes, parking and just reading out some things which could be important for rural place of worship photobooth.

Then recycling, hospitals, we want youth centers. So, let us go to hospitals. And let us see if we have healthcare also. EHI, EHI is arranged in, yeah there you are, so hospital is there so

will click hospital. So, let us add one more layer and say if healthcare is that amenity personal health care, but we can see some other themes, what are the themes could be there? We could have? Yes, we could have government healthcare comes up. And then we can also have government hospitals. There is no hospitals, there is no rural. So, it keeps on updating. So, it is always good to check what else we have.

We have hospitals we have healthcare and then there is nothing for rural but we can say government and see if there is any rural entities, there is no rural. So, I think we will stop here, will remove this, will just say or and we will say that we need a layer extent full states and Chhattisgarh. So, I am going to run this just for Chhattisgarh as I said, and then go to the Advanced, we may not need the lines, nodes and multi polygons is good enough.

And this will run throughout to see which ones we have. So, it is always good to run twice to see if there is multiple data sets. It will tell you that one layer has been added which is the amenity hospitals. Now I am going to do is see if there is amenity hospitals run query. No SM objects selected, please select one. So, we do not have the object. So, let us say node and multi polygons, and then it is it is running on top of it. So, mostly if you know the point data, you can estimate the polygon by drawing around in Google Earth.

There is no results, so this also can happen you will have a successful query but no result, which means that yes, you have created nodes, you may have nodes around the area, but for Chhattisgarh it is not there. I will not be surprised for reasons that it is a lot of forest area.

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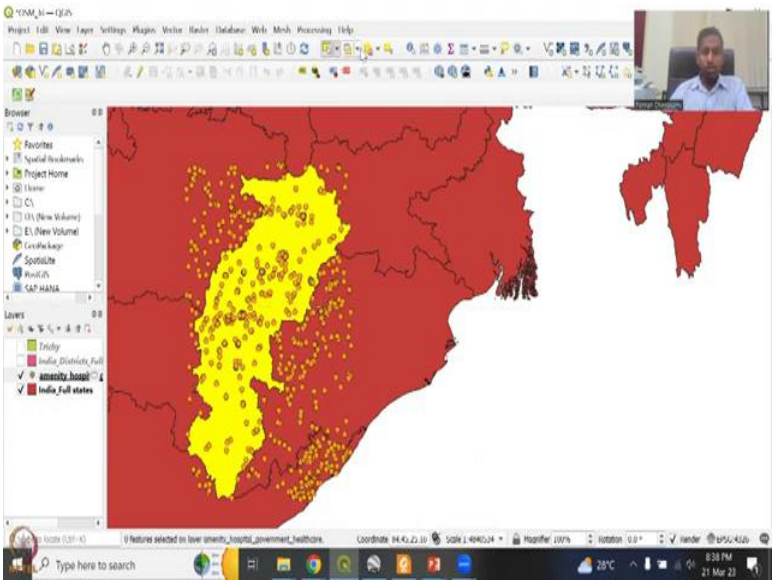

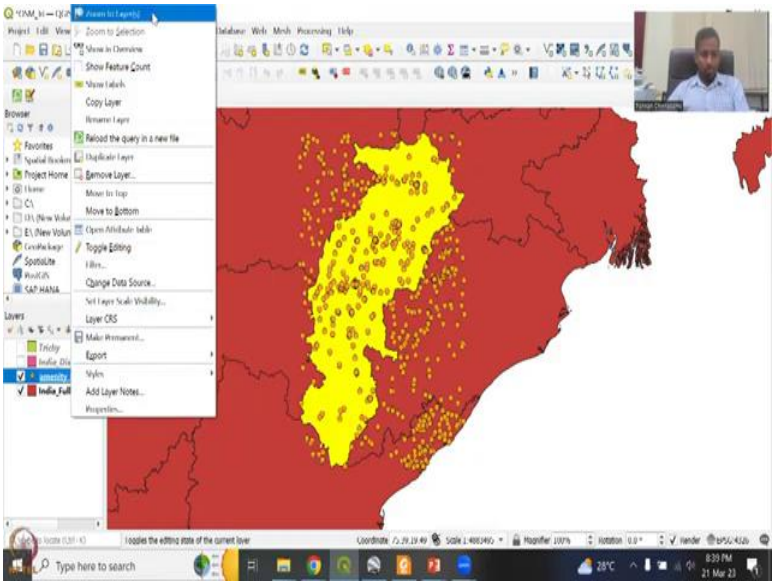
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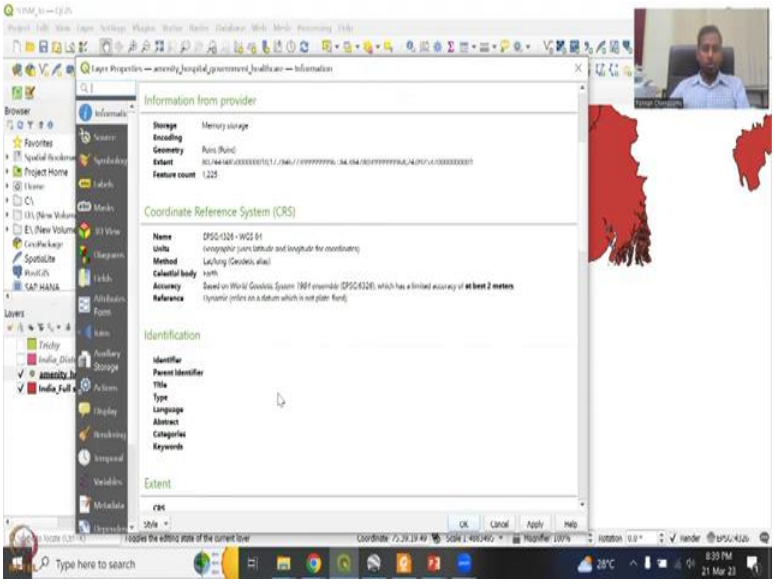
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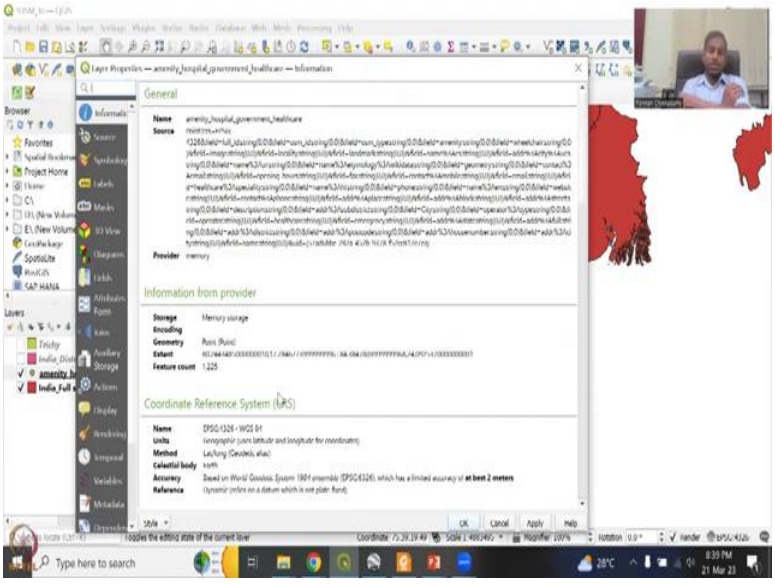
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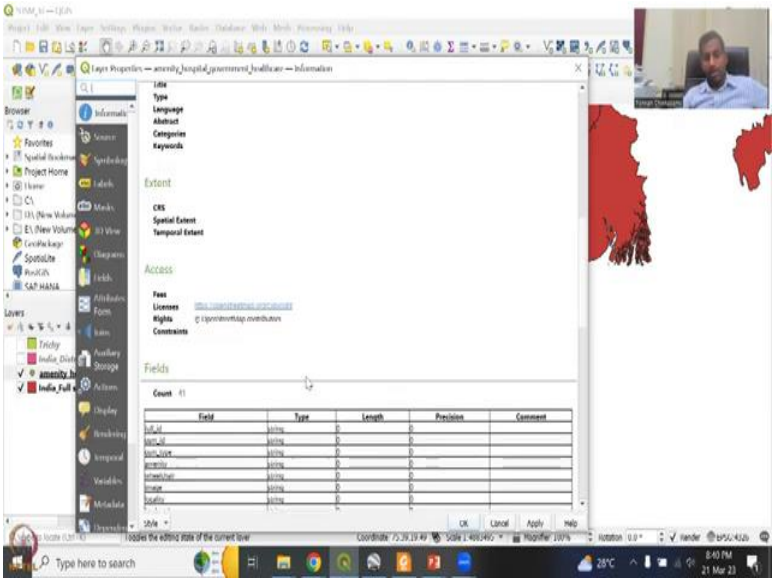
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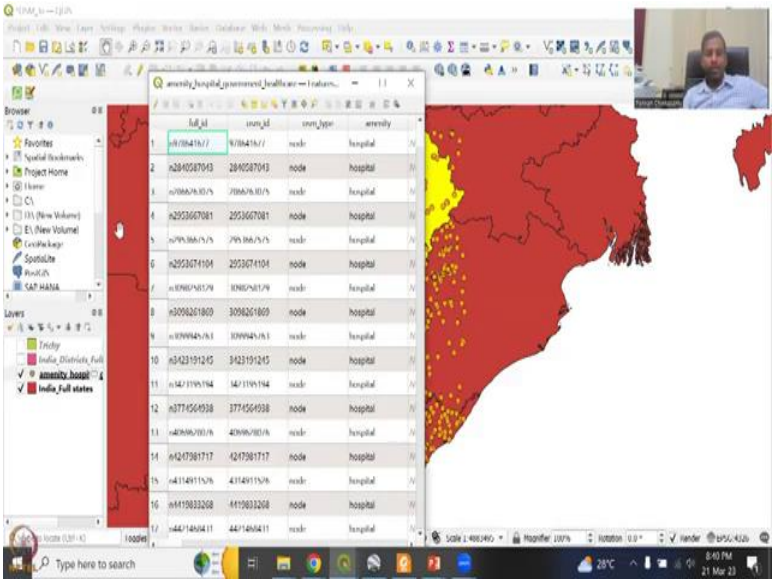
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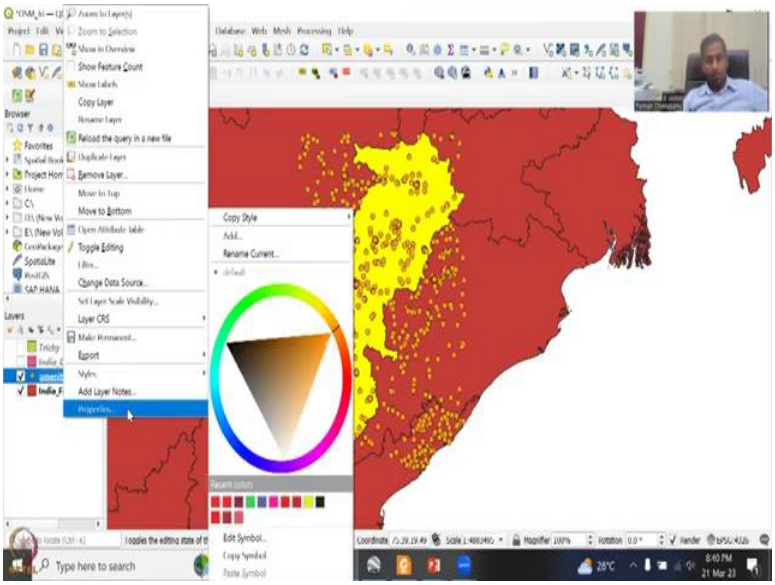
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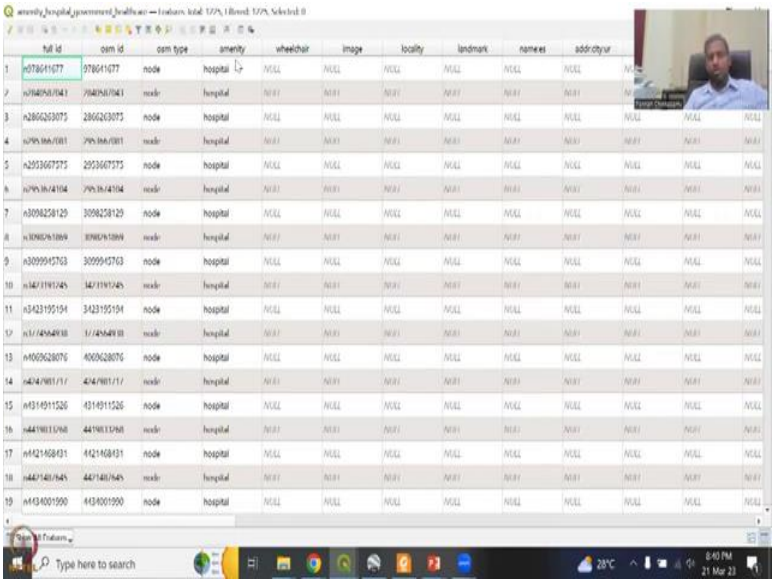
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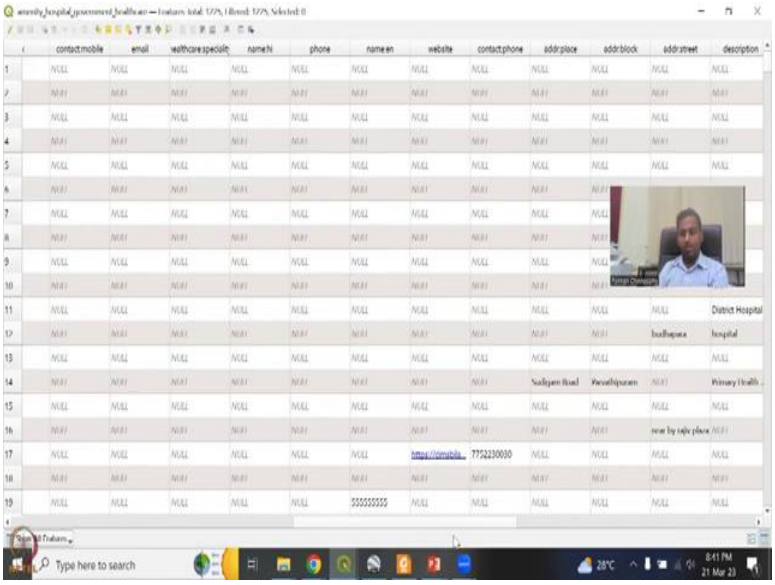
21 Mar 23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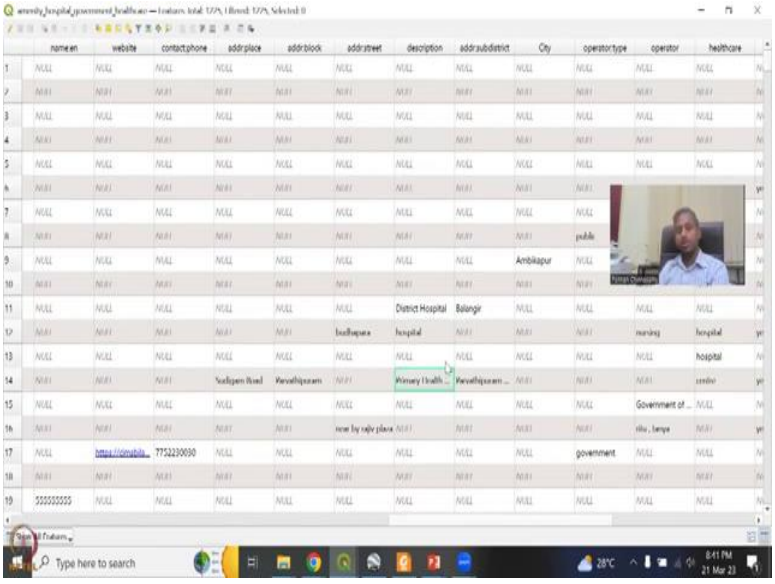
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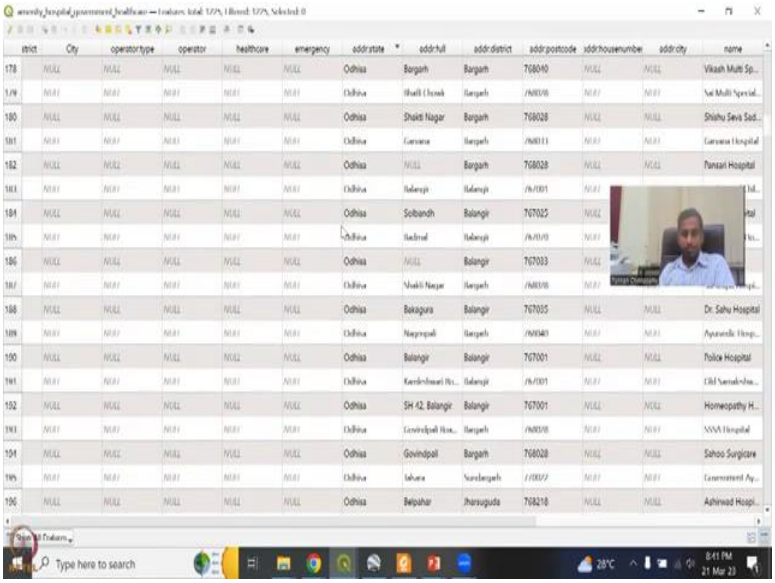
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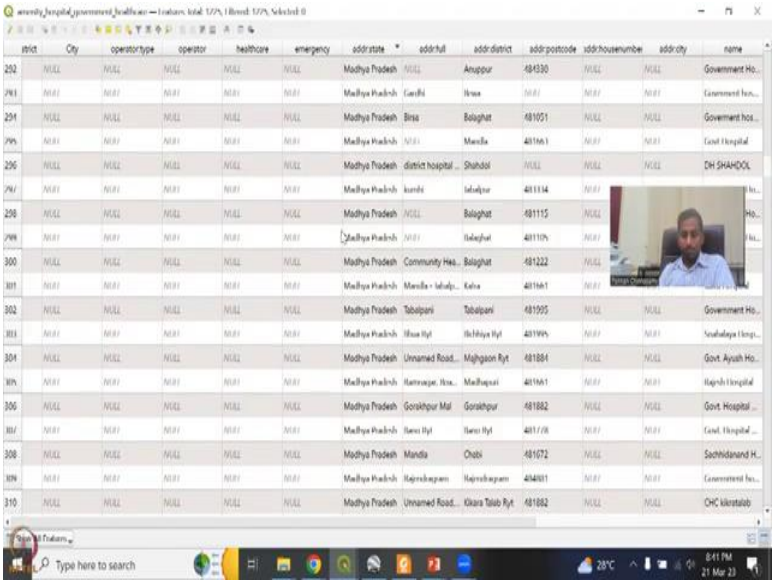
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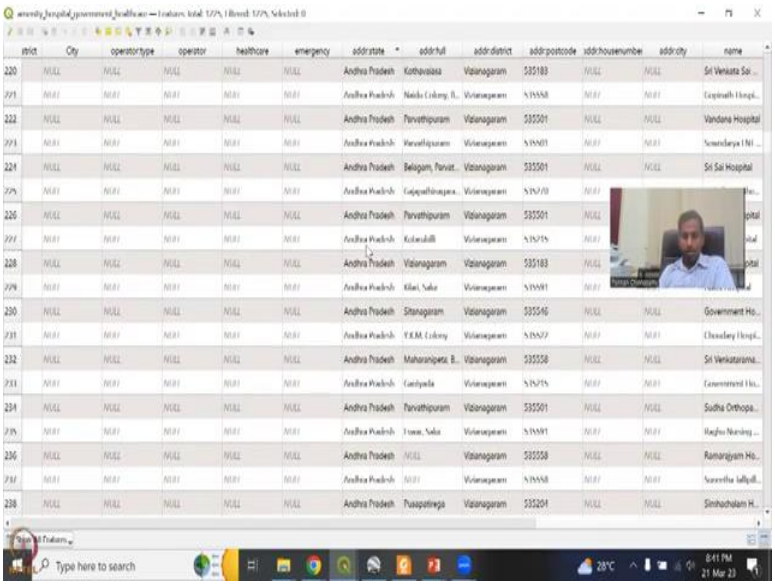
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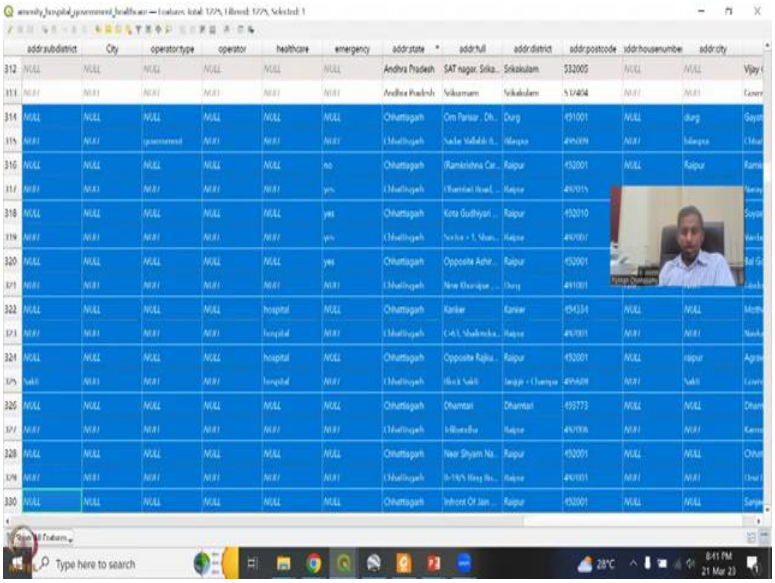

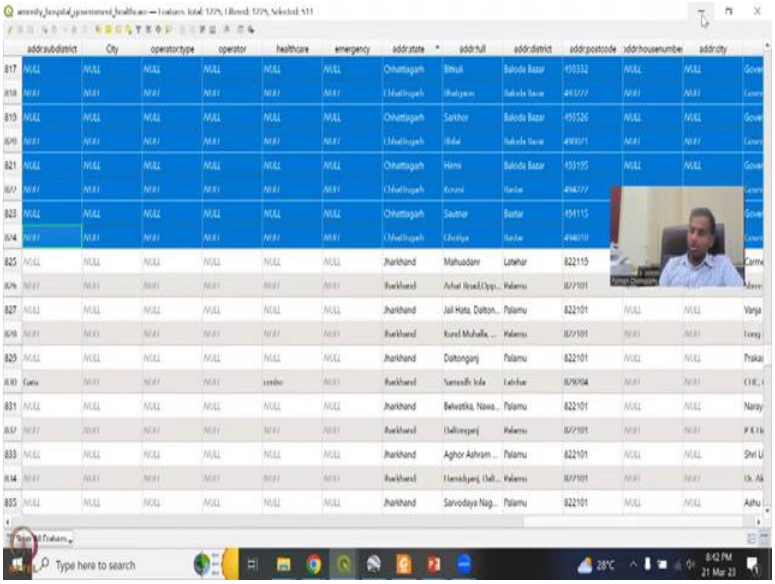

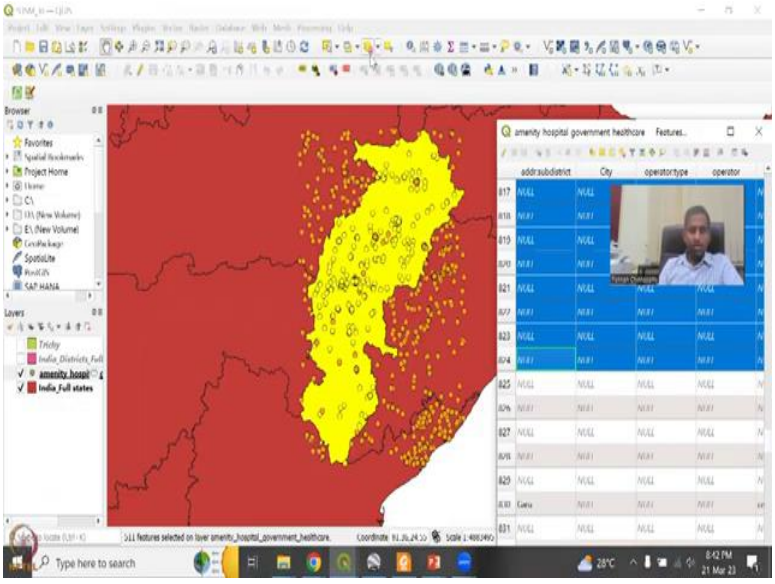

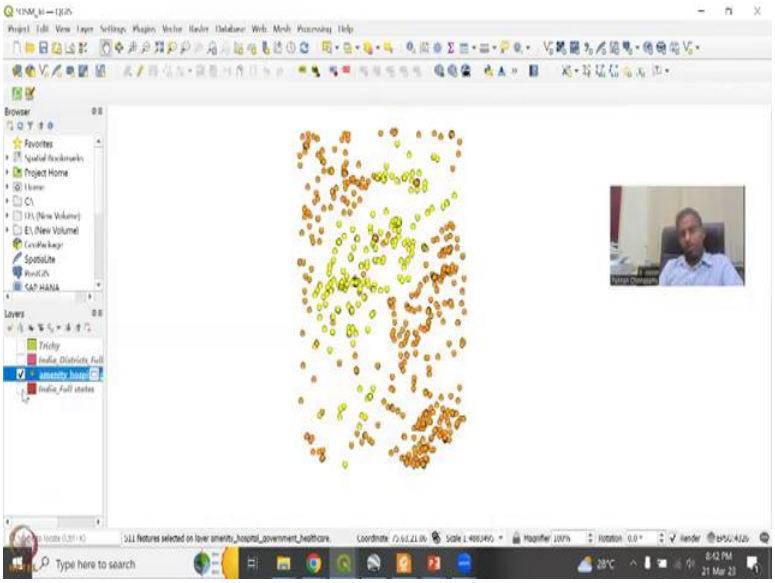
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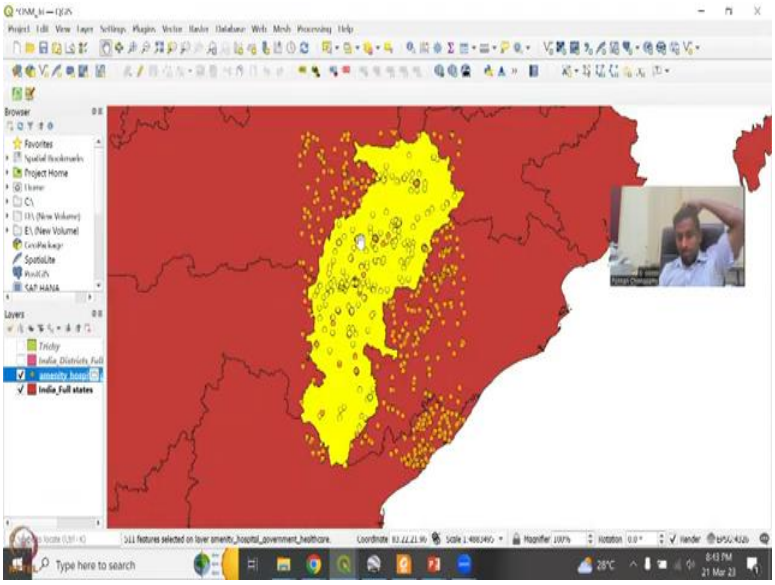
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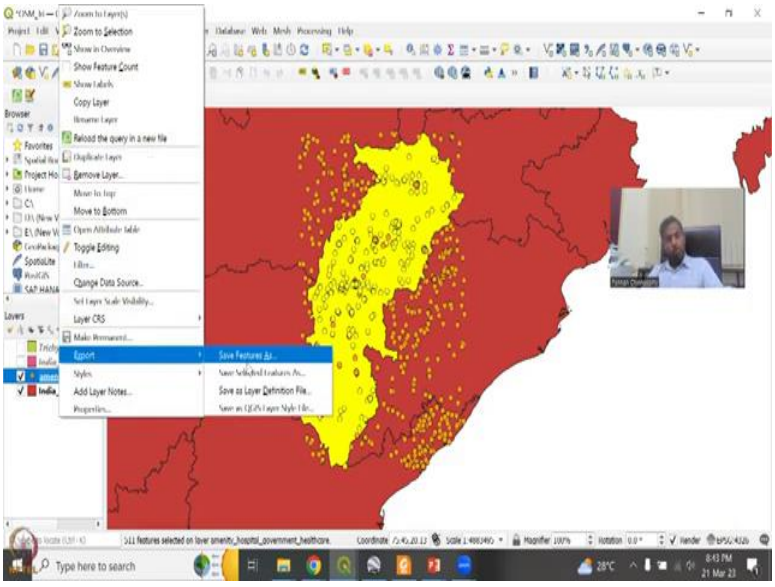
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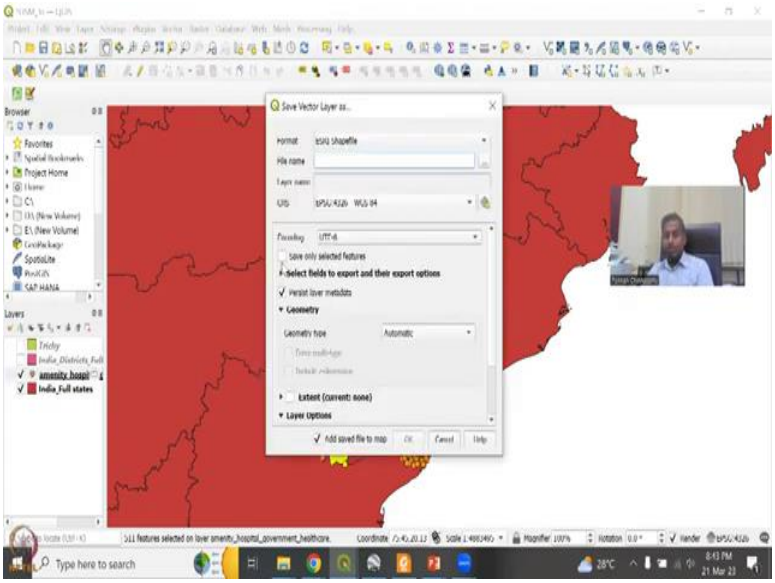
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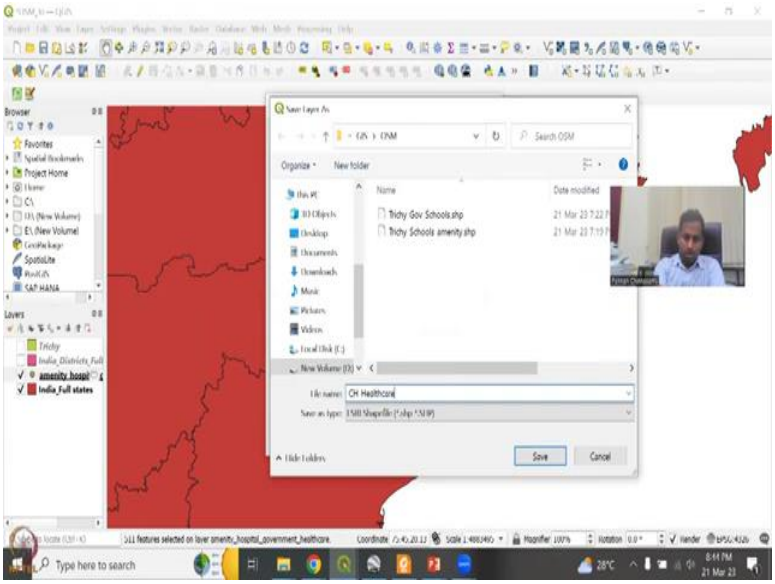
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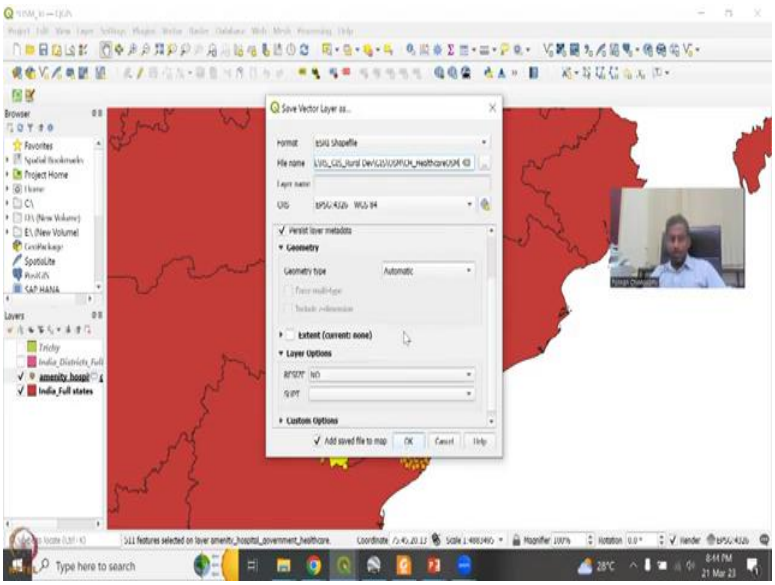
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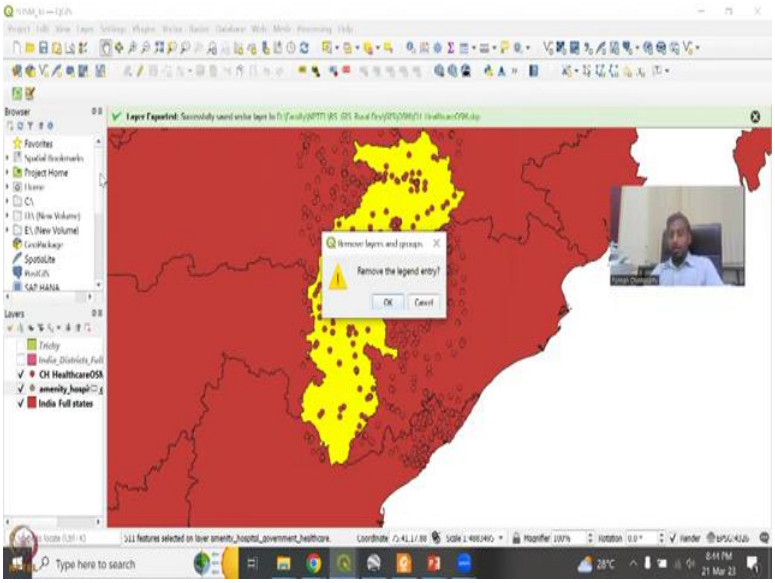

So, let us just click it down. And you could see that a lot of Chhattisgarh, around Chhattisgarh is like a tile, it is like a tile the data has been there. We do not know how good the data is. But we will surely find out by zooming in.

So, I am going to just use my pen. So, you can see that these data would contribute to Chhattisgarh we can mask or clip the data out. So, that we can see what data is there. But as usual, we could plot it so I am going to do the properties. So, in the properties, which I did not explain in the previous slide, for the previous lecture, which is lecture 3, we did schools so in the schools, I did not go into the metadata, but I thought I will explain it here because it is the same for all.

So, in the properties. If you click then it is a source a lot of things a lot of links for the source, but more importantly you have the extent what type of data it is and then the accuracy based at 2 meters best accuracy the coordinate system is good and this is the more thing so the license is being given to Open Street Maps and the contributors. As I said initially, the access is free. But it is good to cite these people because they have put a lot of time on creating these datasets and map and also maintaining the service. We will see that what are the fields that are there and what type are they all are strings, there is no numbers, because it is just going to be named.

If you want areas that we will do later, you will have that also, the source can also show you like what is the source that adhere healthcare systems. And you can also have symbologies if you want to change, these are the locals we can disclose it. But if you go to the Open

Attribute Table, you will have the fields that we have there. And specifically for hospitals as different types of field names, wheelchair image, locality, name, city, your city name on geometry contact papers email, phone number.

Website is there for some people, some businessman would like to have a website, what type of health centers is there, this is a primary health care center PHCS PSU they call for the rural areas and then there is a district hospital district main hospitals and then there is a government non-government hospital all these are government nursing, is private maybe and the state so here we wanted more Chhattisgarh not Odisha Andhra so these can be removed or just I will show you if I just click this and then say like this, you have all the from upside down I would expect more null to be there.

So, that is why I went down. So, yeah you have null little so Andra Pradesh is there and hopefully will jump into Chhattisgarh, yes. So, I am just going to click on this and then drag. Sorry, click on the Chhattisgarh and then drag so that you are highlighting only the Chhattisgarh region we can also build a query for Chhattisgarh we are going to use CTRL. You can also use Shift to just select all of them. Let us go down to the end of Chhattisgarh and then hold on shift and then click.

So, now what has happened is we have selected all the Chhattisgarh it makes a shape file out of it. And you can see that if I remove this clear selection for remove this part, you can see that the Chhattisgarh selected as within the Chhattisgarh area. So, you can have within the Chhattisgarh area you have selected all the layers, all the hospital locations within Chhattisgarh which I have Chhattisgarh, yeah others are errors but they have somehow creep into that because of the buffer region also, and maybe the locations when they specified somewhere they would have put Chhattisgarh, the open source contributors.

It is okay as I said, there are some hospitals inside also without Chhattisgarh name this could be the null ones where you can add the names. The best way to check it is by using remote sensing. So, now we will export this as hospital data. Let us say exports, it do you want all features or selected features I want to export all just, so that we can see where they are located.

And we want to say Chhattisgarh smaller name CH underscore hospitals health care, in also right OSM circular, OSM most spaces in the names as GIS rules use underscore and no special characters. You can save this and add as I say file to the map and you can remove the

temporary file. This is a good thing about QGIS it allows you to create a memory in a temporary file so that you do not waste your folders and the space.

If it does not work. If you do not like the data, it just removes it. So, you can say yes I want to remove the other one. We have this part.

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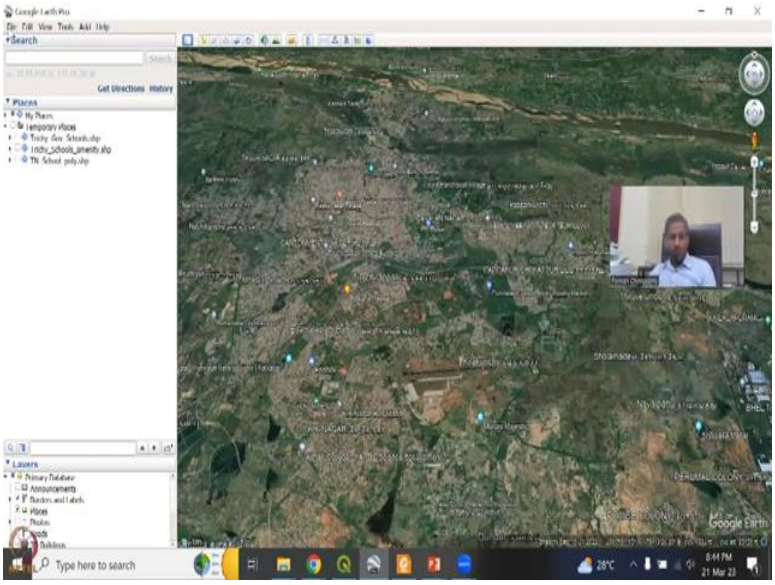

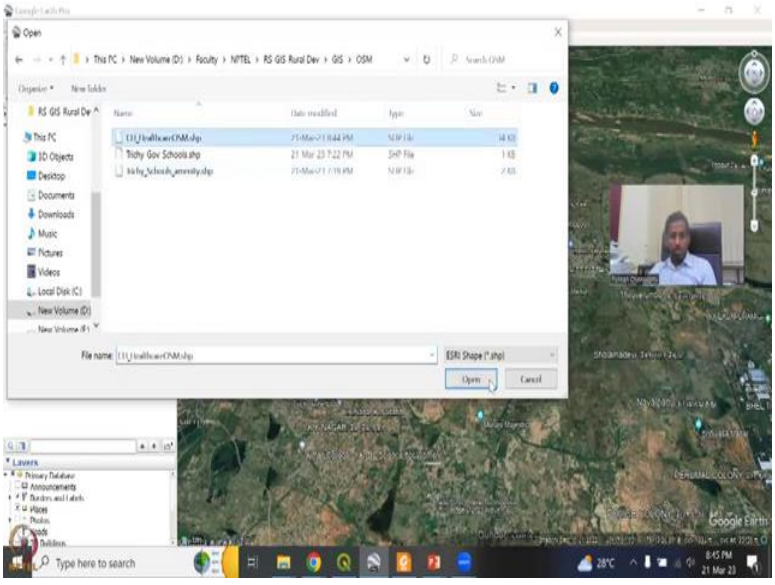

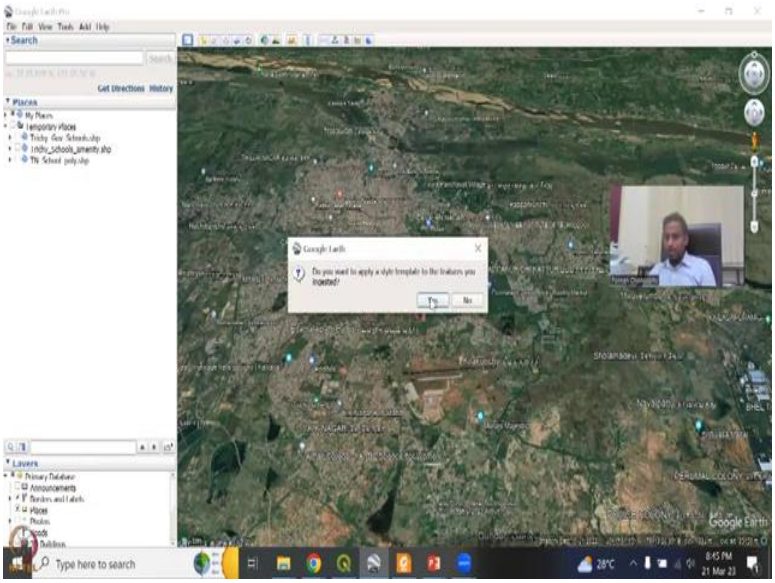
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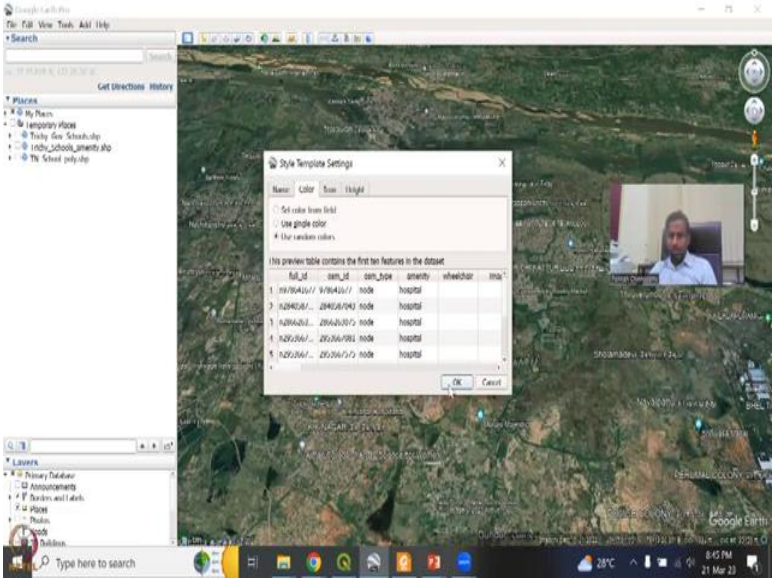
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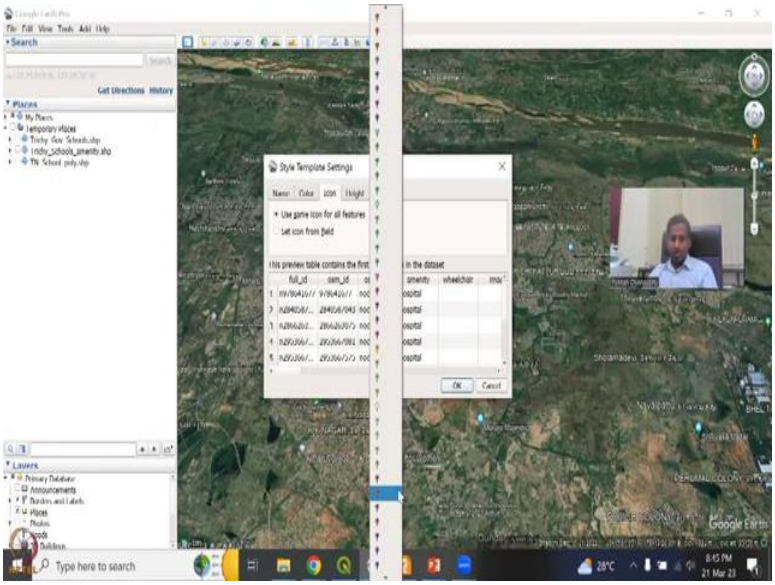
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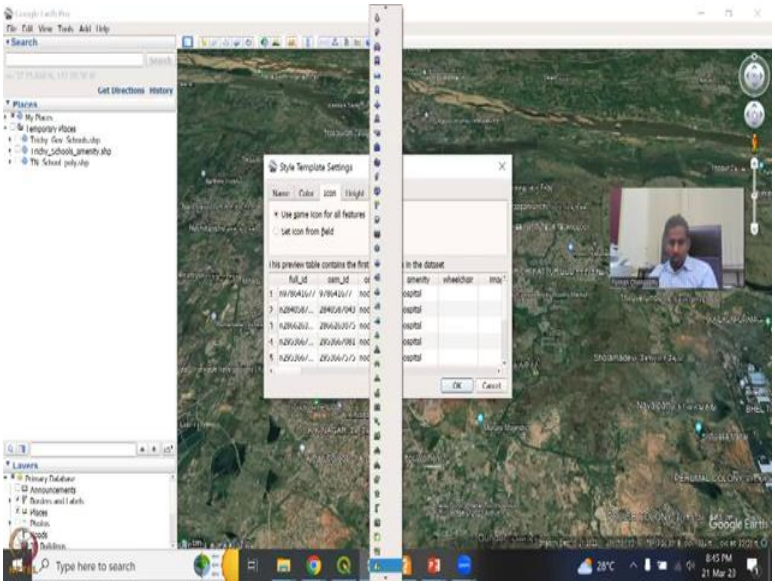
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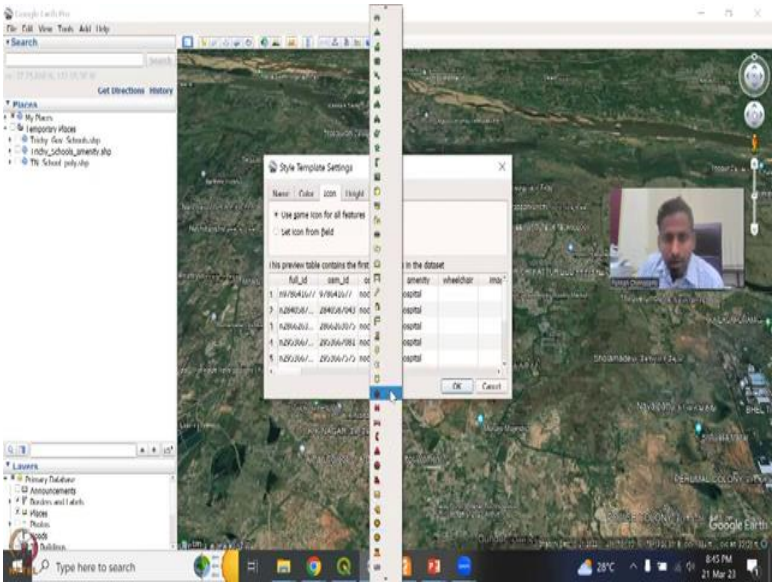
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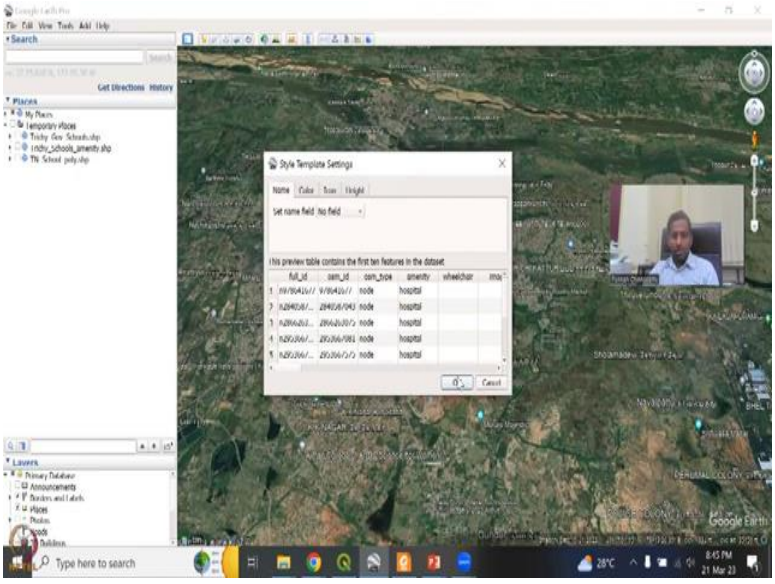
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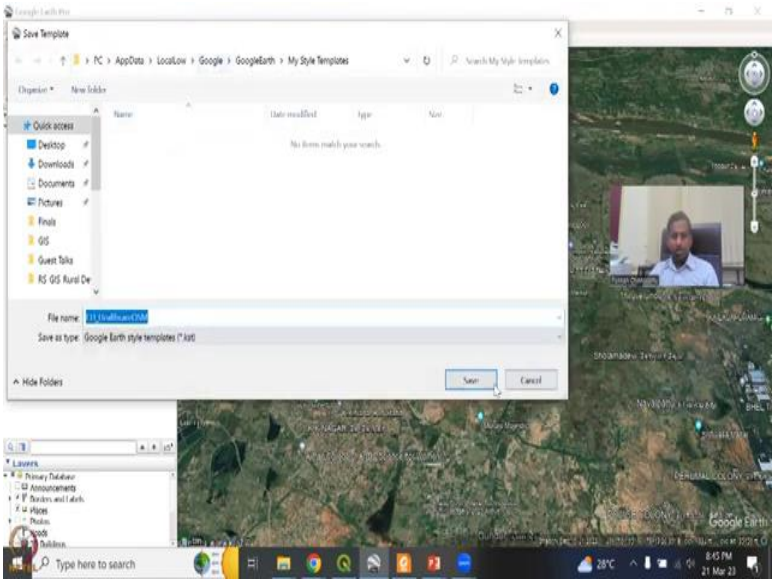
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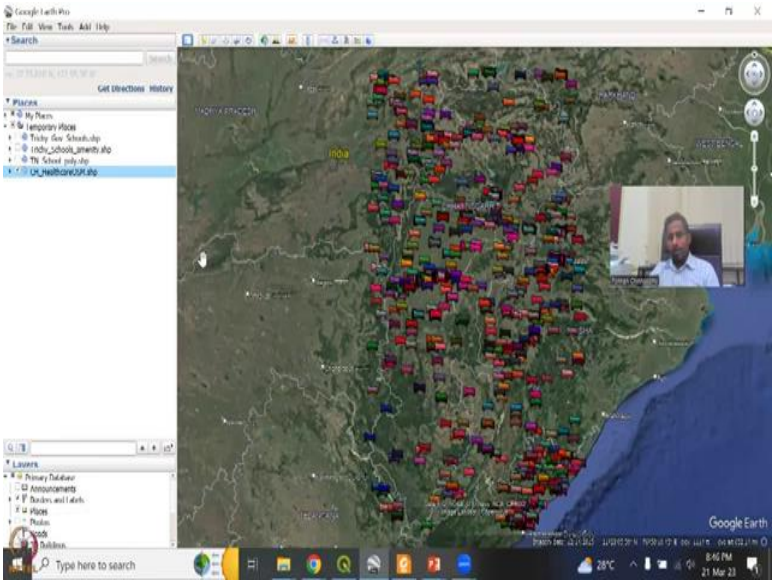
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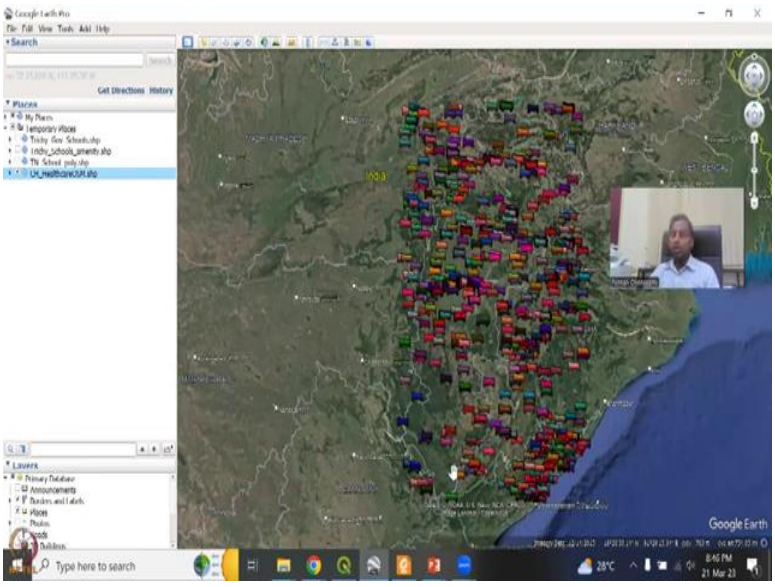
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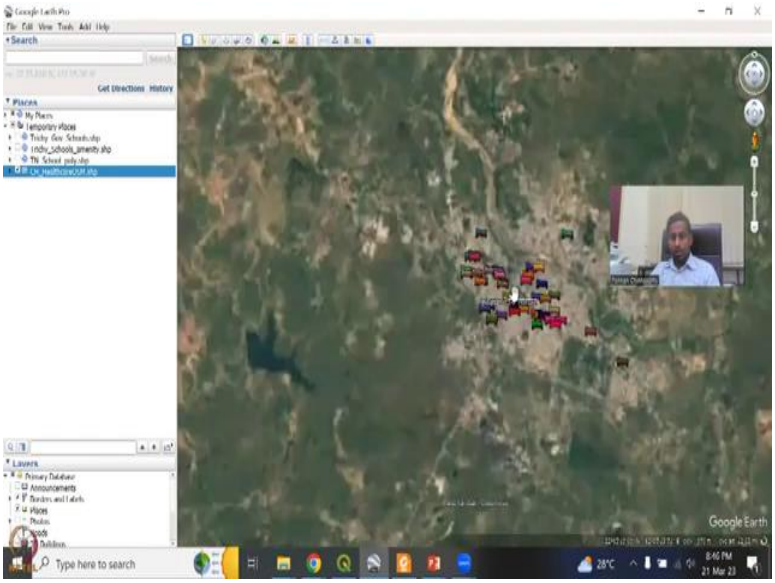
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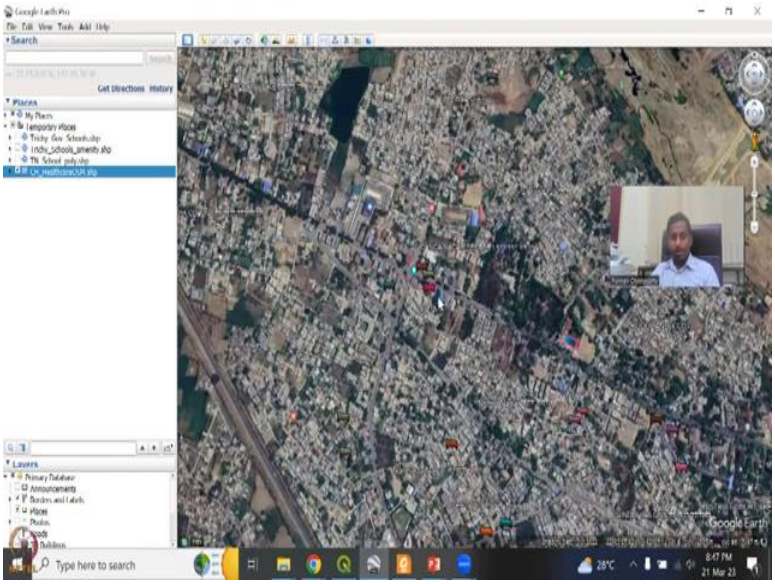
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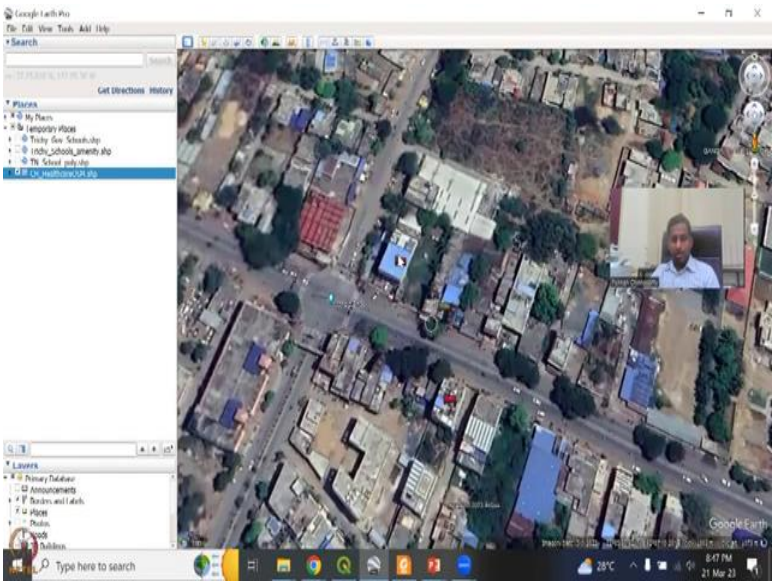
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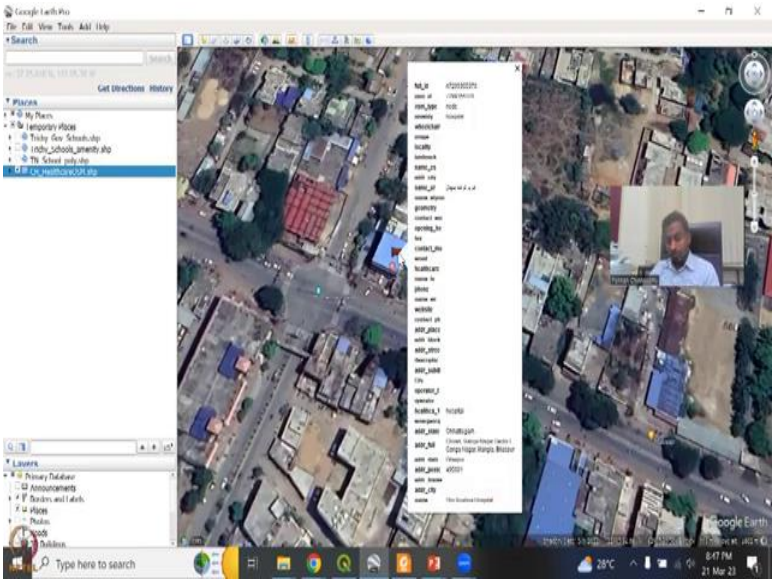
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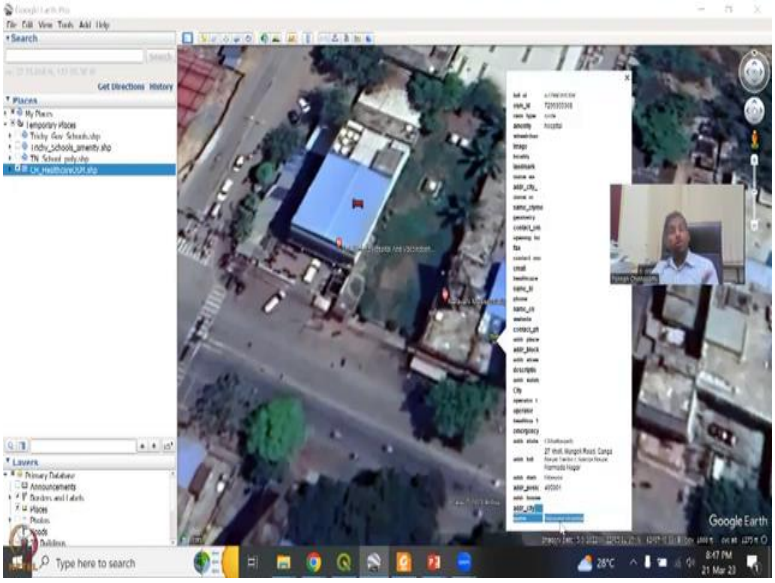
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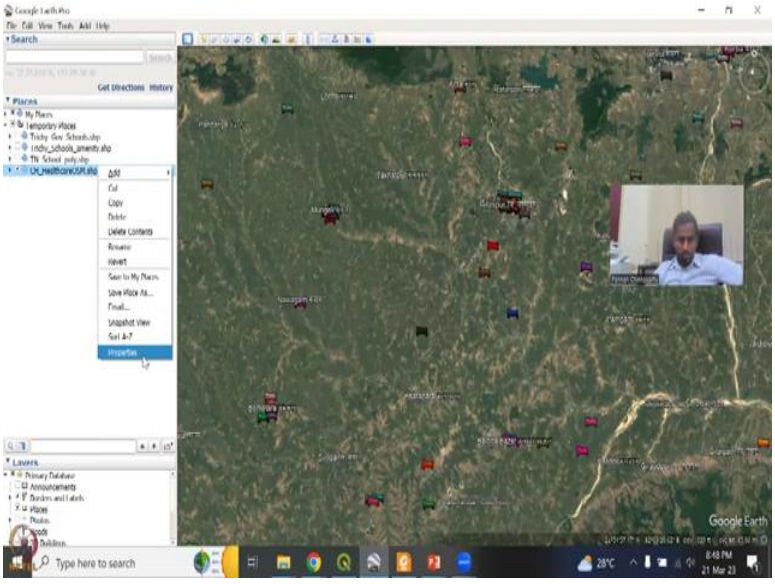
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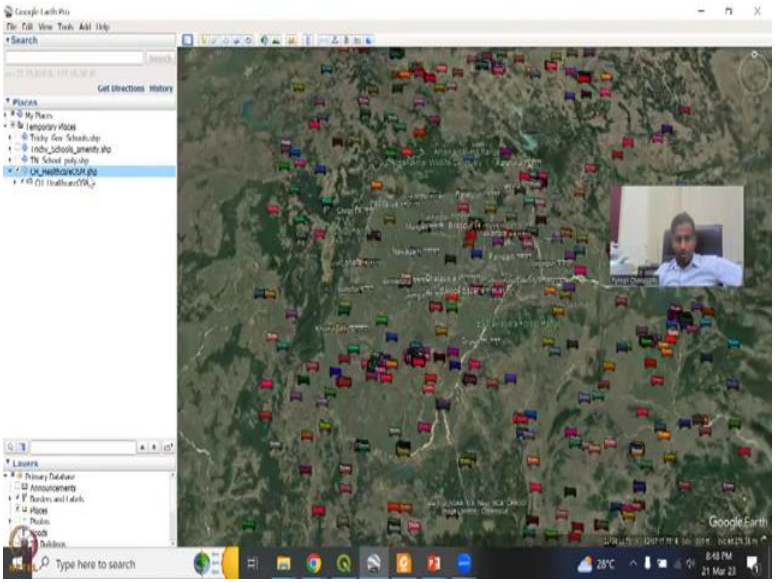
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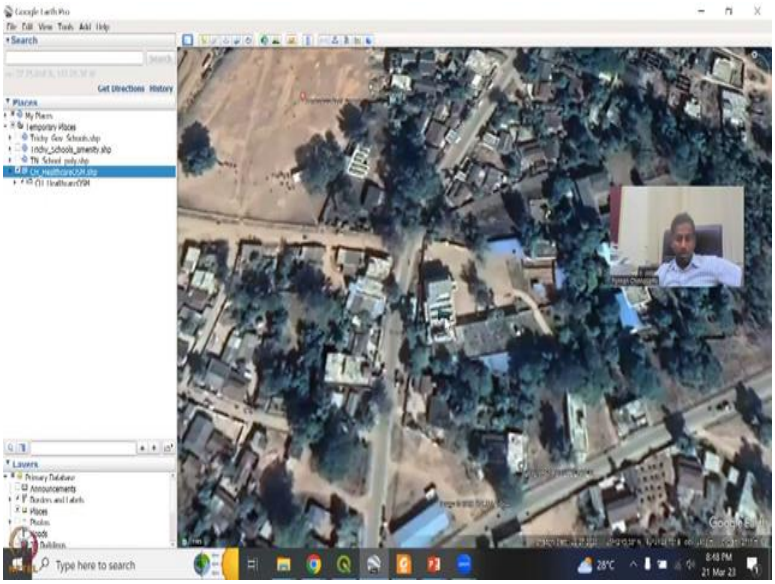
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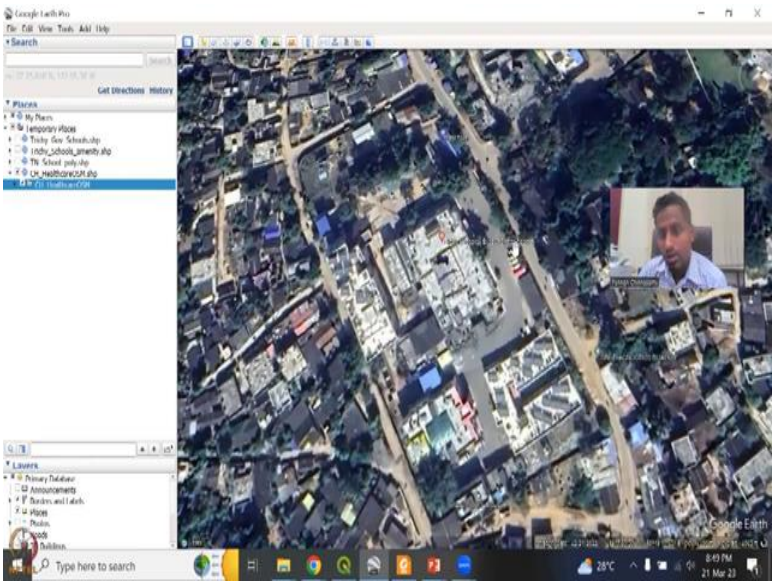
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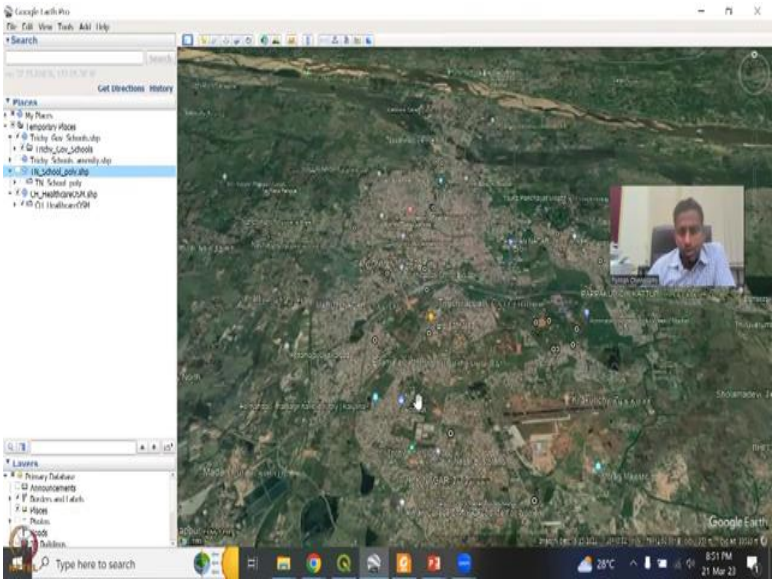

Now. We will open our Google Earth again. And we are going to add these are the previous ones of the schools now we are going to add the hospitals from a different areas open OSM CH, do you want to adjust the style? Let us do once okay let us say yes while show you why this will not be that you know do you want use a single color use random colors you can say use random colors icon do you want same icon or different icon you can have different icons here you can pick the hospital for icons.

Let us see multiple icons you can always change it later but it is house, you can have this for normally for hotel abut we can just use it and then height is this keep it as same. So, name is there, I could say okay, and you will see do you want to save it, you can say save or cancel, it will start plotting in Chhattisgarh. So, moving from Trichy to state of Chhattisgarh, you will not see the boundaries yet, because I have not let the boundaries to come up.

Now I click the boundaries, borders, it has come up. Again, go to view, make sure the tilt is okay, reset the tilt and then click on this to see the hospitals. So, beautifully. All the hospitals have been marked, we can so one thing which comes out blatantly is this region where the most forest region are very, very less number of hospitals. And so we want the we would be needing more here because of the rural population and the rural livelihood options that they have here.

They have better livelihoods and options; it will need hospitals. So, we can go here kind of a bigger city, which has a lot of I am just randomly selecting, there is nothing that we have in mind in terms of specific areas of interest, you will see that how the hospitals are being

mapped. So, let us see if that hospital is correct. We can just click on the field that was created I have click on the bed and you can see it is a hospital node hospital address Chhattisgarh address full address, and the name is Shri Krishna hospital. Let us see, see it says Sri Krishna hospital and vaccination.

So, there is there is a very good, association between the accuracy and the names when it comes to commercial places. I say commercial because these are more into the real of payment services, this is a vaccination center also maybe during COVID they had a good access to these kinds of things. So, you could see also another hospital here it is Narayana, Narayani, Narayani multi-specialty hospital, if you click on this, the name is also Narayani. So, these two are not same data this is Google Earth Pro data.

So, kind of an oversell data, but as I said, in rural regions, this is not being updated. So, which I will be showing now. So, the city coverage is pretty good, which you can use and which is also needed for rural development, because mostly they go to cities for better access of hospitals. So, let me zoom to the layer, or zoom out. You can save this as the layer, just double click it zoom out, then do the view reset the tilt. This area let us focus on the bottom part, where as I said, there is a need for more hospitals along the city boundaries and stuff.

So, if you zoom in, you could see that here the names and borders, maybe populating but this has not been populated. So, which means this is Assis Shanti Bhavan, the name its admission hospital in Chhattisgarh, but there is no data on Google Earth Pro, which means that it has not been updated. So, this data set which we are using from OSM and mixing it with Google Earth Pro is the best data set for now for the assessing the health locations.

So, as we said there is a need for more and more of this data to come up. Because if they are underrepresented and not being mapped, how do you map it now. So, you are a researcher, you want to use remote sensing data for mapping, which is good. So, you can actually use these OSM to update the data and put it into this network. So, you can see here, this city is a district hospital. So, normally this district hospital would be mapped in google earth pro, it gives you said it is a big hospital in the states as district hospital, Bijapur Chhattisgarh and that would be the same here just name here it as district hospital.

But the city is Bijapur. So, you could actually get better of this data update the versions, not only the Google Earth Pro data can be updated with OSM, the OSM data can also learn from mix and match. So, your goal is to keep your GIS layer up to date by collecting as much as

information as possible, the local languages are there and other languages are there, you could add it, good. So, I will also be happy to do one more round of using the road network because road network is very, very important we said. And I will show you how this is also important.

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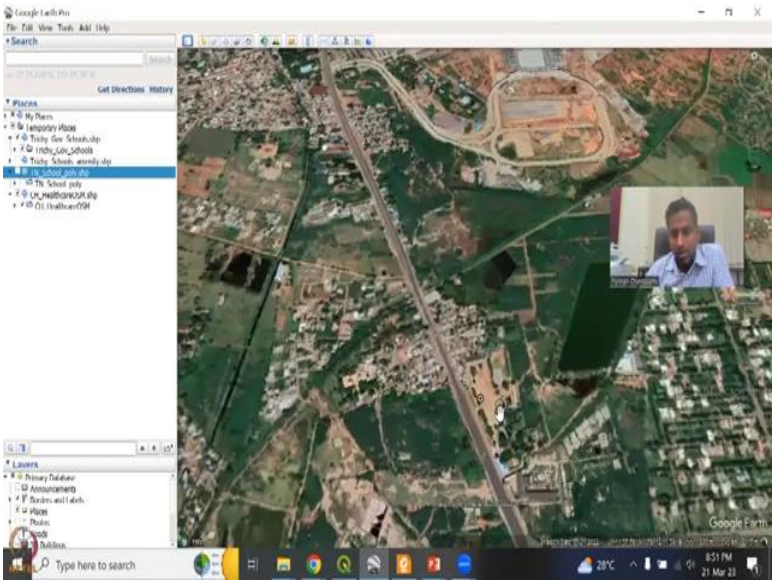

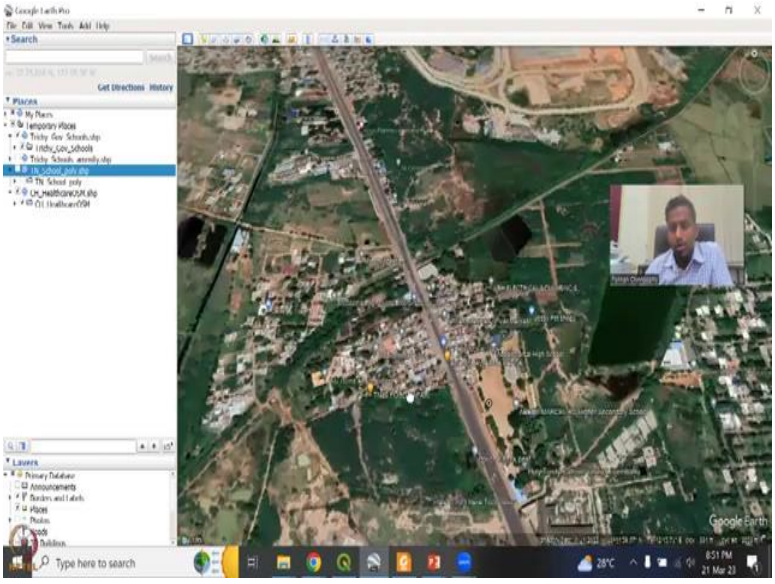

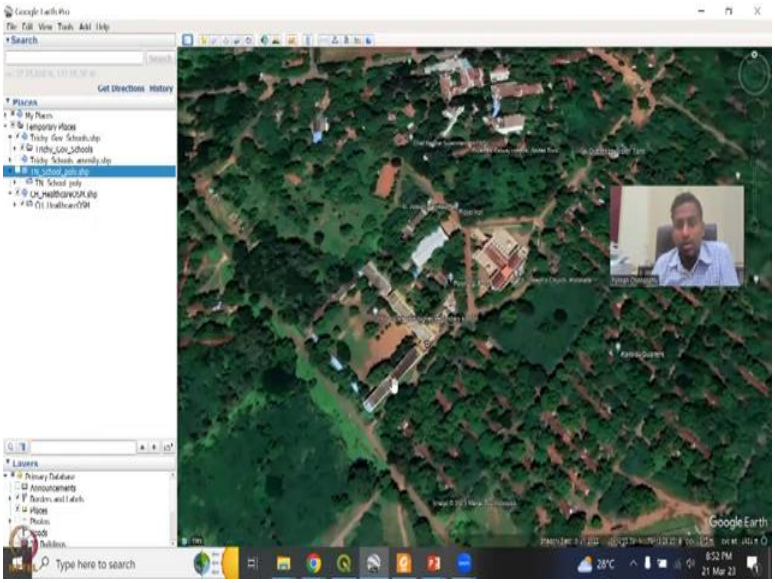
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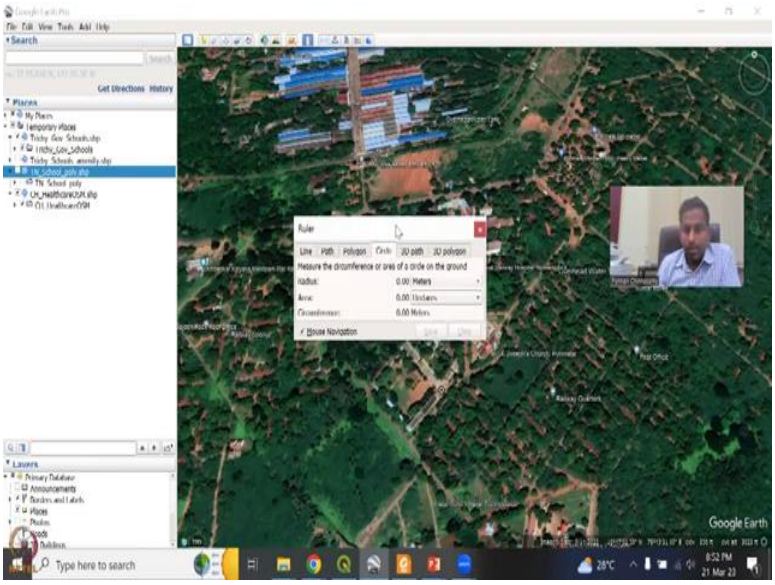
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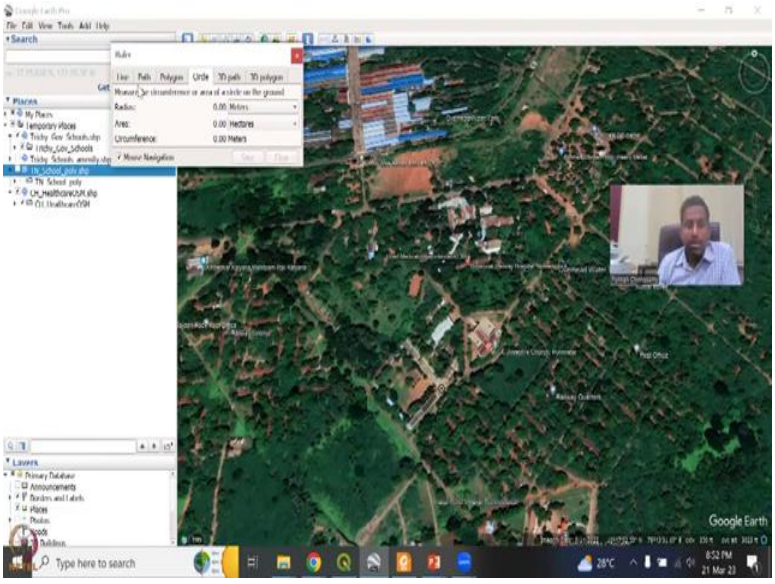
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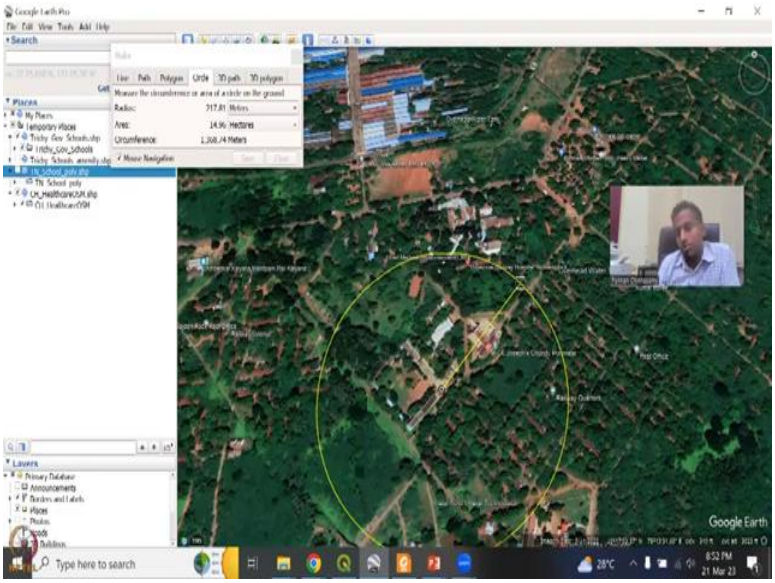
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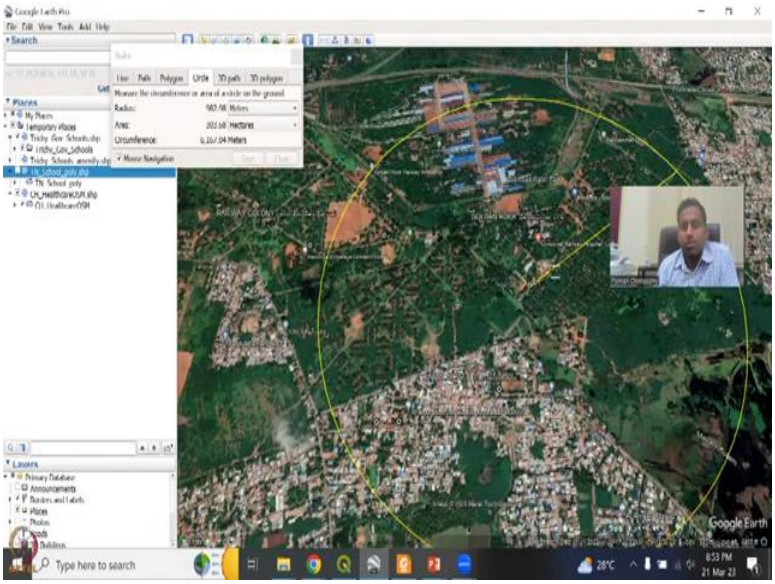
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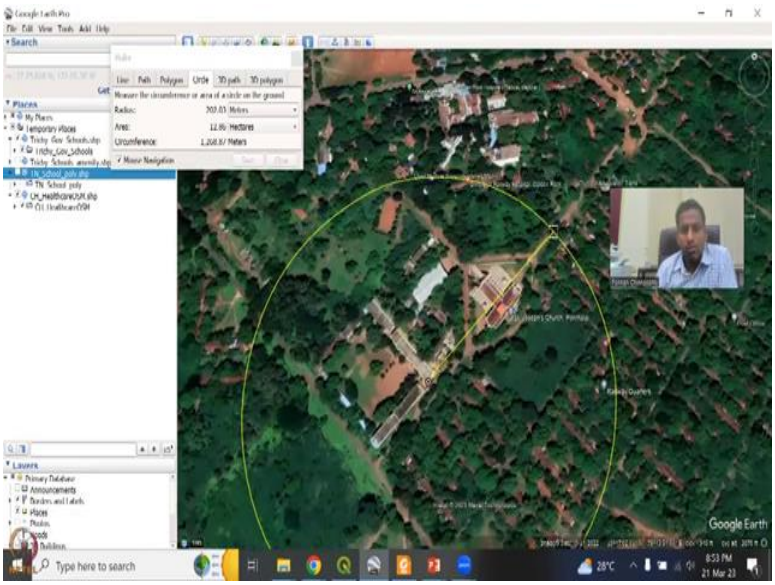
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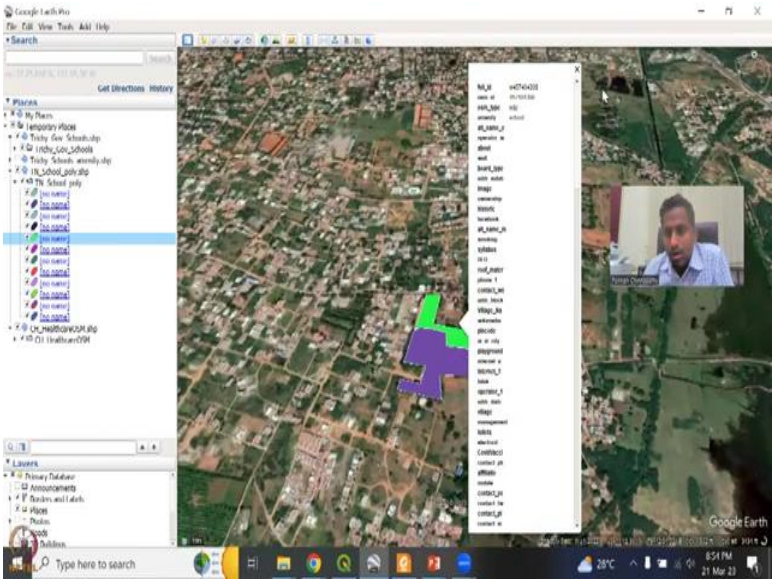
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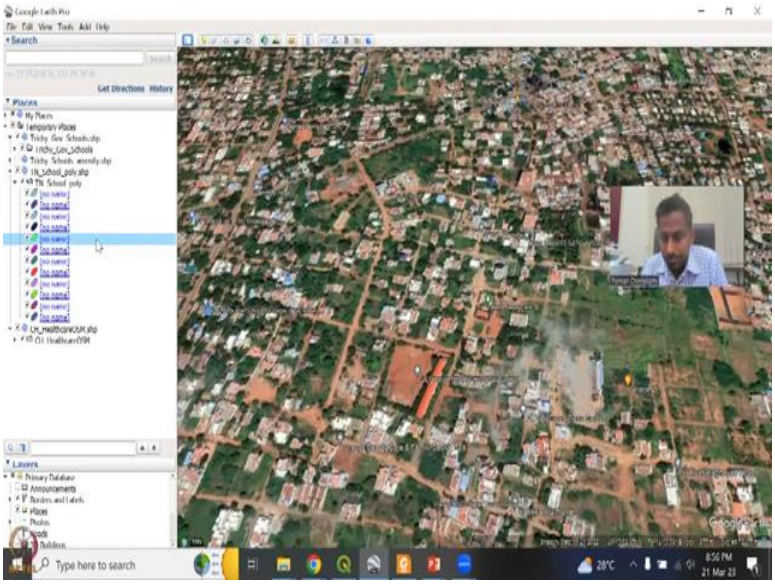
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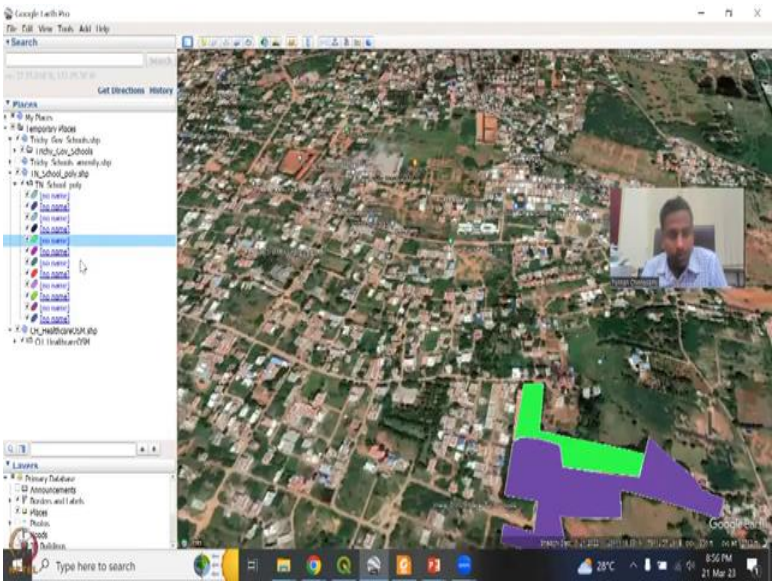
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So, for example, we did this course. Let me go to Tamil Nadu schools again. Or Trichy schools will go to Trichy schools, because will be happy to. So, these are the Trichy government schools and the private schools that we map, and how do you know that a school is village rural entry or not? If it is, mostly in the in these kinds of areas where we have a lot of buildings, then that is a city, say it is in a very verbal encounter, will say it is a city or not. And this is a big school. And then we can say it is about Marsel RC high secondary school.

So, there is not behind that there is a lot of rural land, but for sure it is on the highway. So, it is a big city or all the way to the city. So, the like these visual stretches you could look at and then see if school is government or aided those kinds of things. So, this is a big school, you can see it is definitely a school, a Holycross girls higher secondary school. And this is kind of a government aided school. So, you could see that there is railway quarters and that is why it is a very housing area what is good here is you can draw a buffer.

So, for example, you need to know how many houses are around so that they can walk or commute to the schools that can be done using your Google Earth Pro or create buffers in your panel I will show both. So, first here, let us say that you need to do a path assessment of path you can say circle. So, I did this the scale and then I went to circle and then wherever you click it will go abroad. So, like this. So, let us say I want 200 300 kilometers one kilometer is is kind of too big.

So, this is 501 1 kilometers is this big, you can see how many schools are covered for houses in this region, but you can make it small because one kilometer of travel would take some time for them. So, let us say 200 meters within 200 meters, where can we have schools, you can just bring it down and then zoom in to see if we are on the ballpark, you can also get 200 so 200 approximately. So, within this you can see that the housings are very low in number and this kind of buffering is needed for school locations and having access to school like in terms of roads, networks, buses for rural regions and stuff.

And also the government in most parts have a ban on certain types of shops in these kind of radiuses like you cannot sell illicit liquor and other things near school. So, there is a radius. So, this is how the radius is calculated you have the location of the school and then you make a circle of radius. So, within this it is more important. While we are concerned is we would

like to see if these are more into the housings and are housings be located within this area and our housing sample.

So, this is one way of doing it, you can actually put a point and then blow the blow it up and then see if the schools are coming up. Will also see Trichy schools or Tamil Nadu school's polygon. You could see that number of polygons are very less because not a lot of these polygons are going to be mapped. You can see that careful drawing is not done for most of the parts so you could see this one. So, if I remove or make this polygon, it says SB or a matriculation and high secondary school.

You can see most of the city here, only some part of the village. You can see here so it is not that big. And also this one is Saint George Higher Secondary School, it is not mapping in OSM. So, you can actually update the OSM. As I said, my village school is not also mapped. And people can map this and provide data. This 2000 plus students are enrolled in this NPTEL course, think about all 2000 contributing at least 10 schools for wherever they are from. So across India, students are attending this course, I hope, and I aim that all these students do contribute to mapping schools, because that would be a really, really good database.

So, there is a database on paper, with geo locations, current geo locations and area, maybe it is not there. So, this kind of mapping, you could actually do and provide the policymakers for rural development and infrastructure development, without knowing the size the status of schools, we cannot have much benefit.

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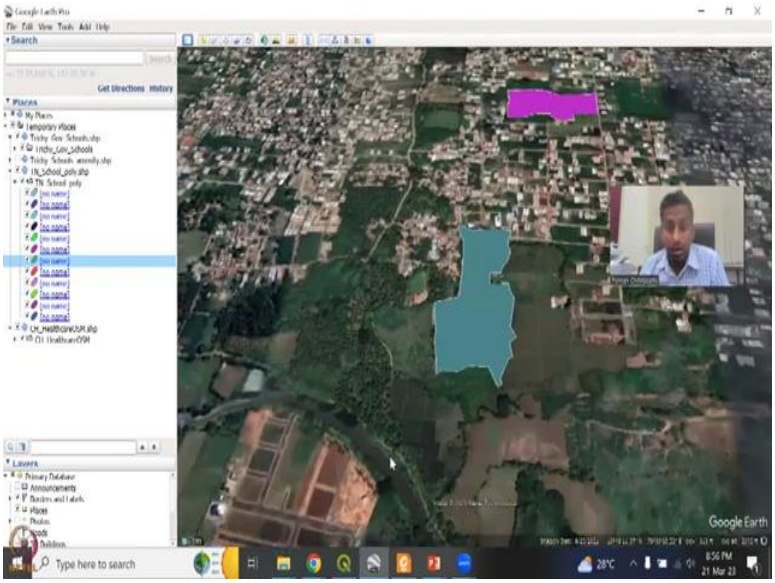

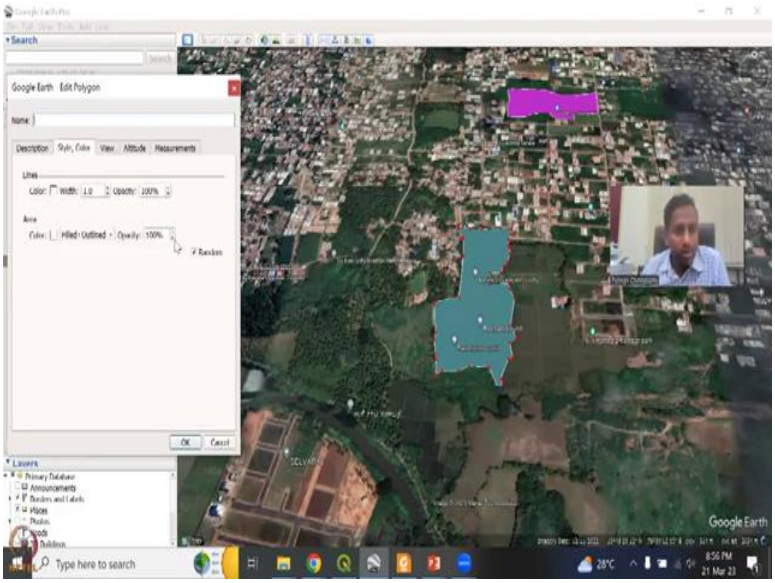
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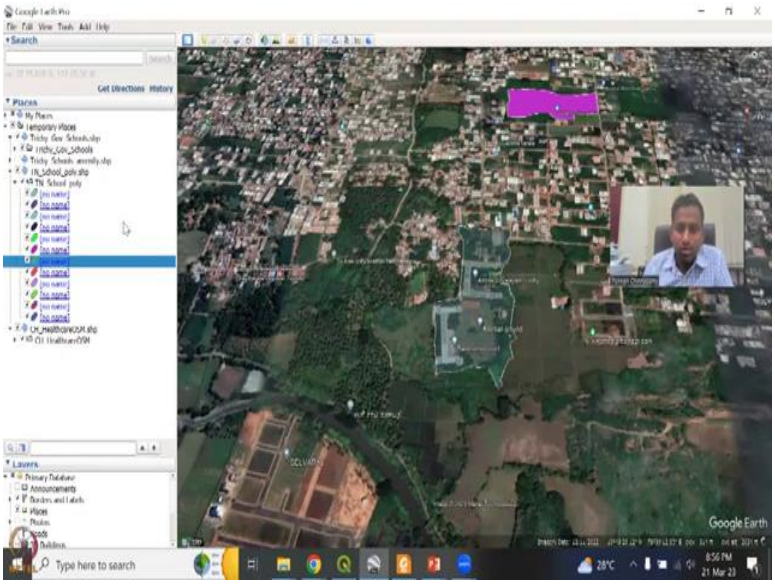
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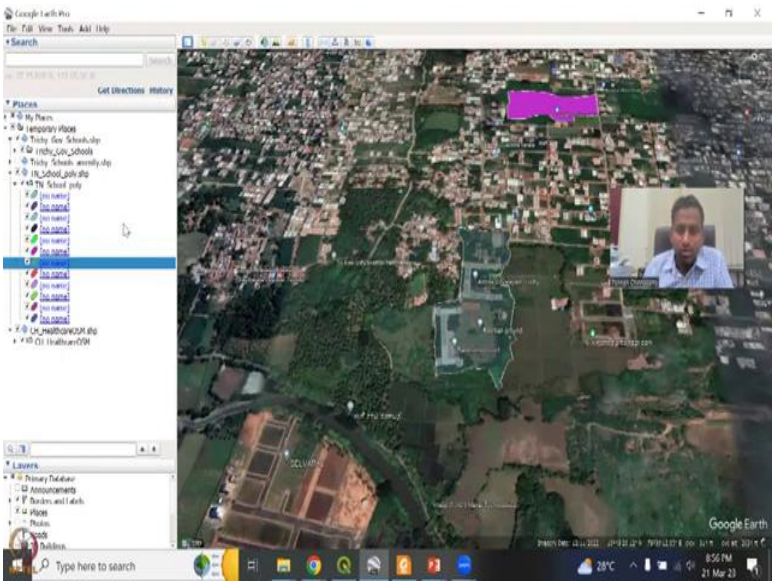
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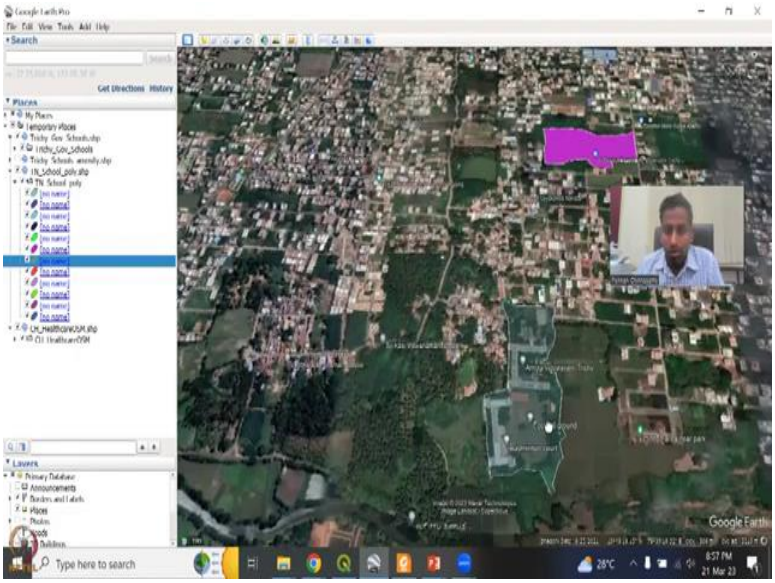
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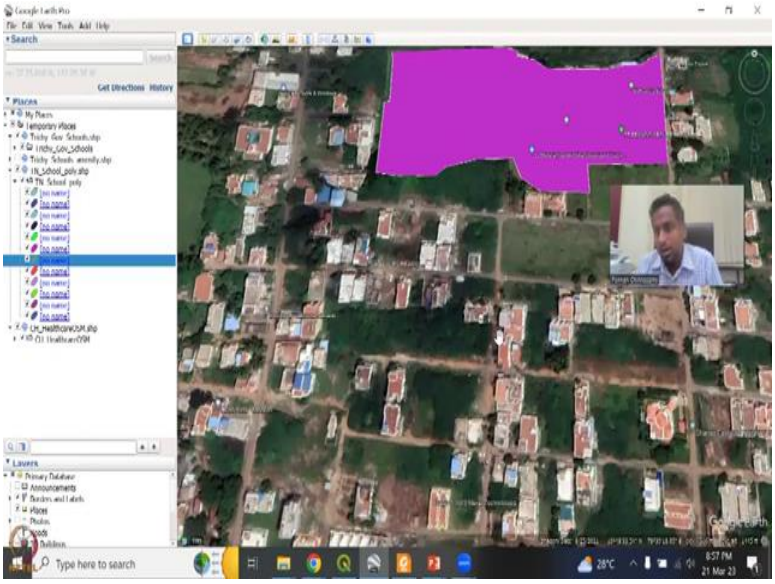
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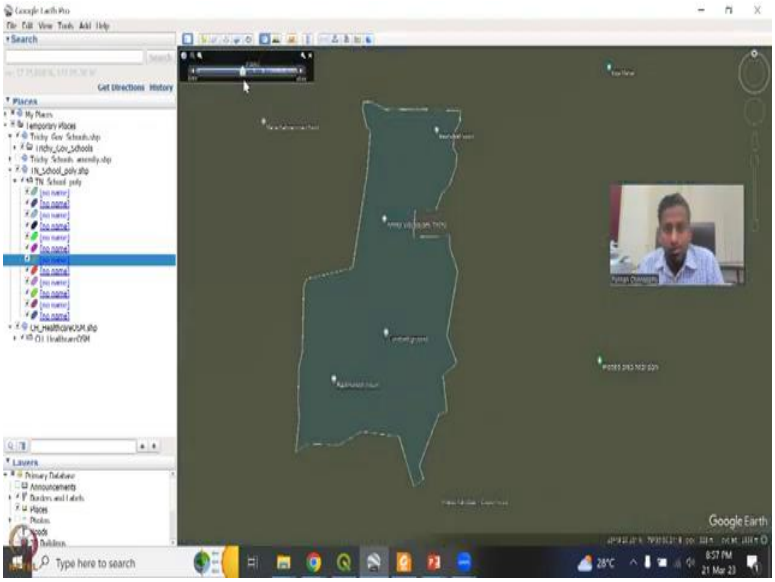
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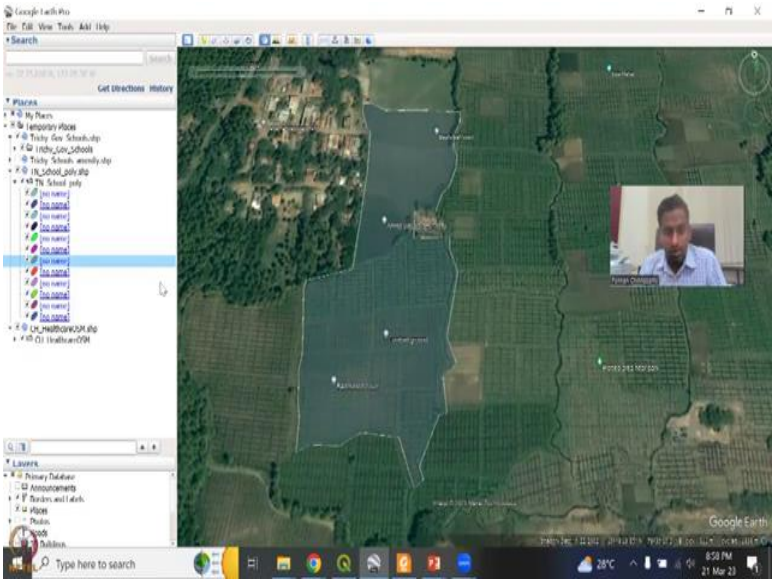
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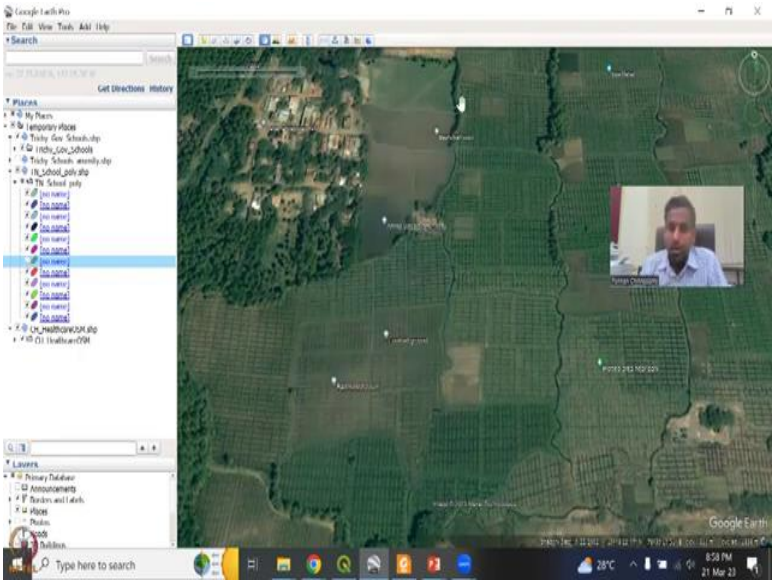
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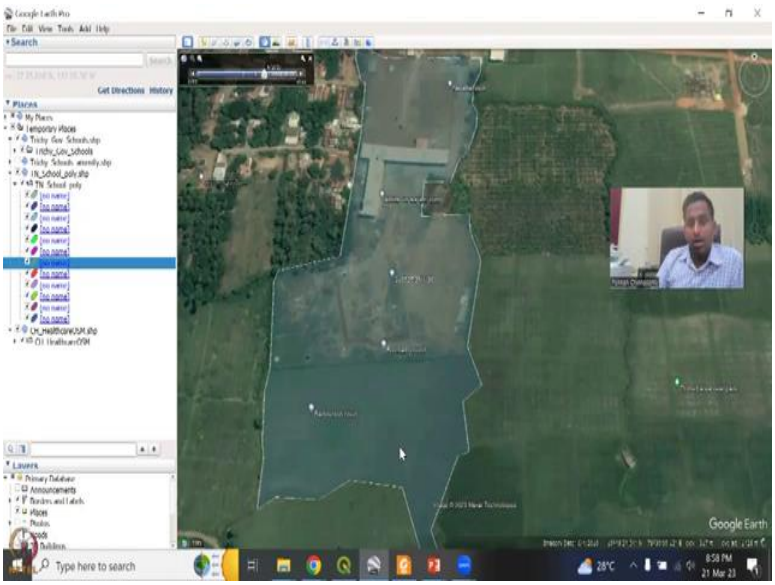
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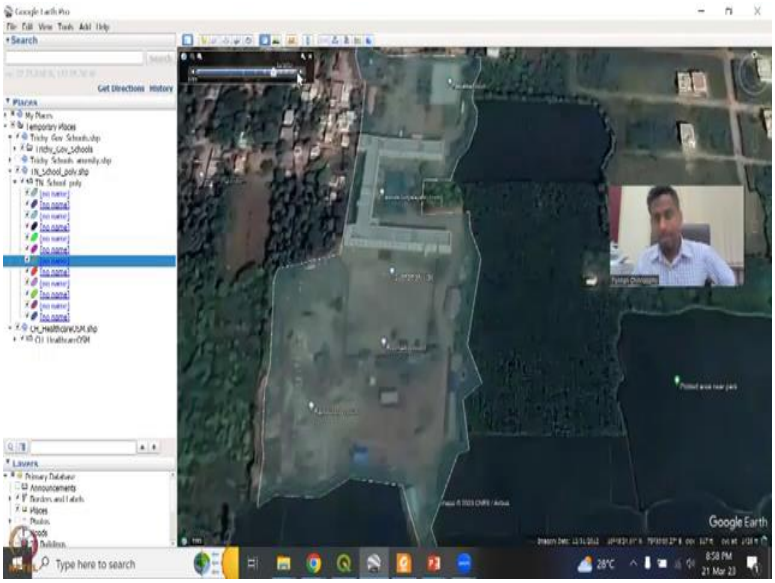
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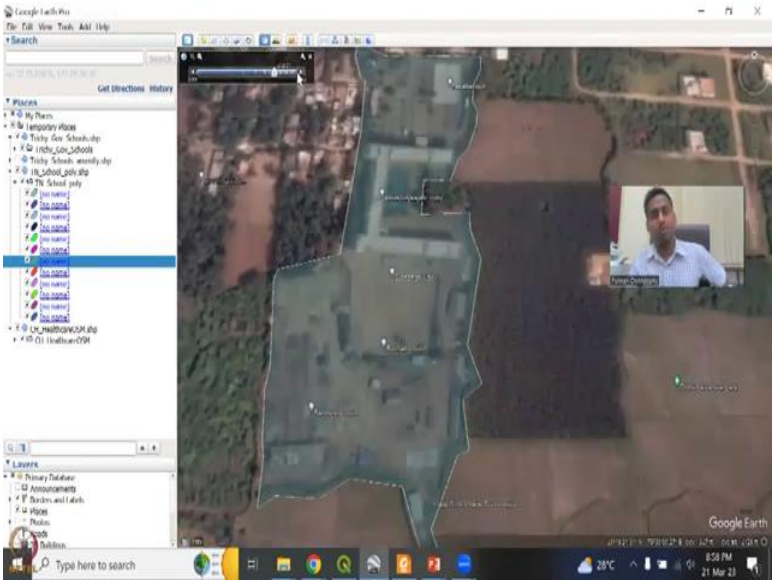
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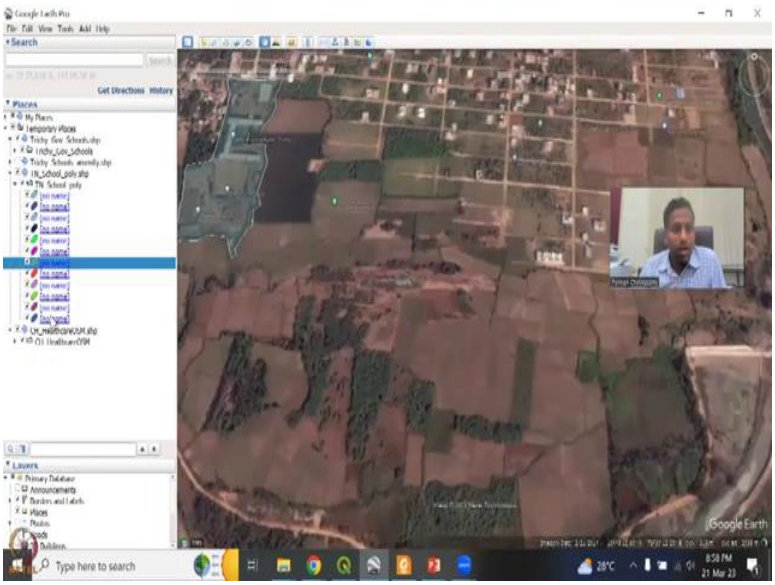
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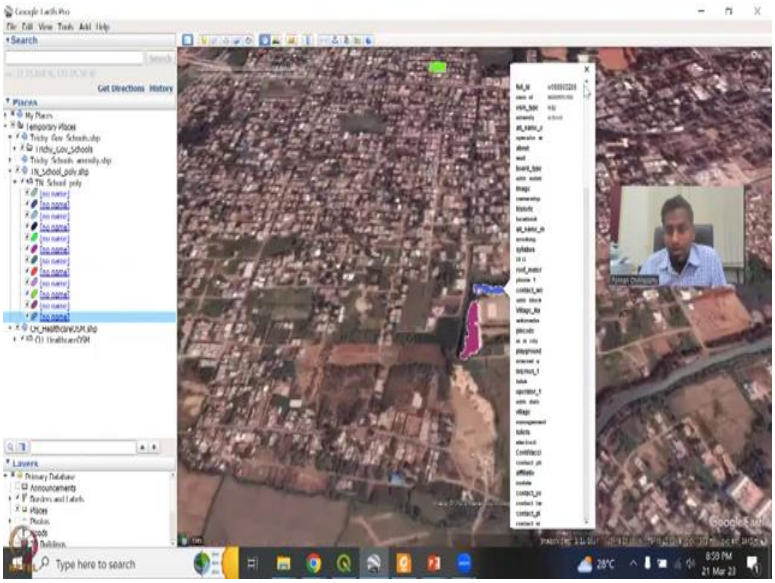

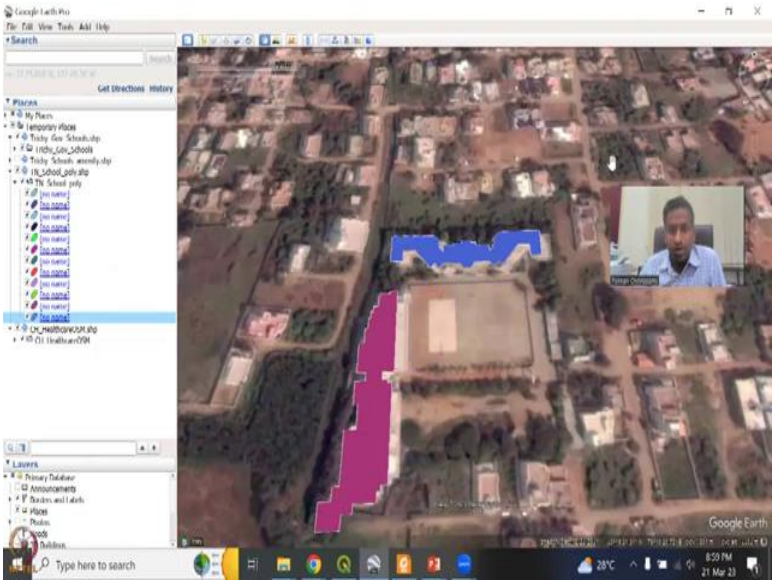

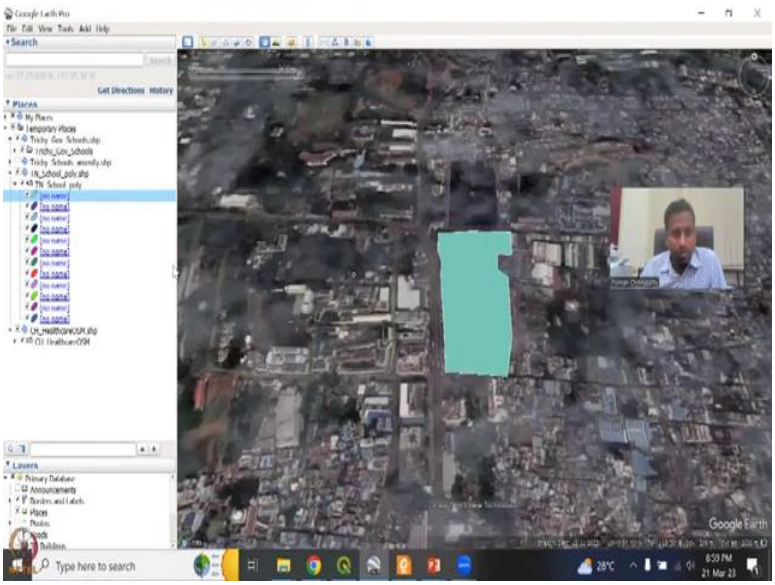

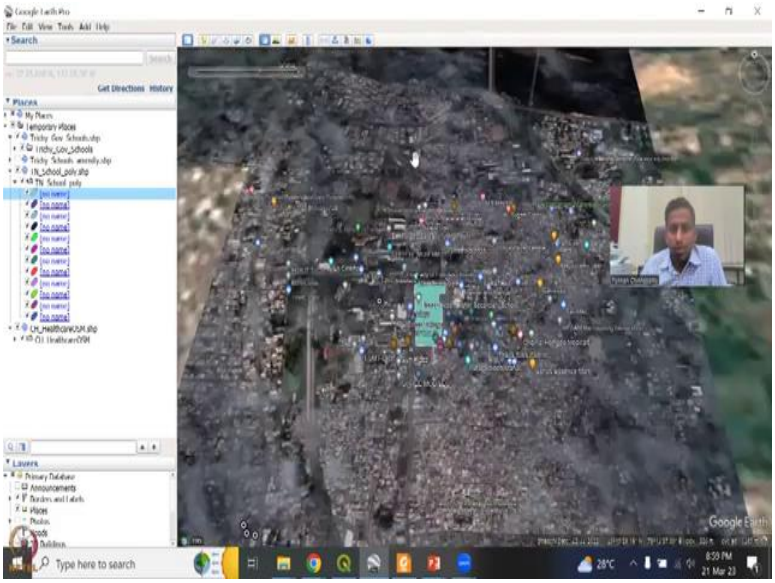
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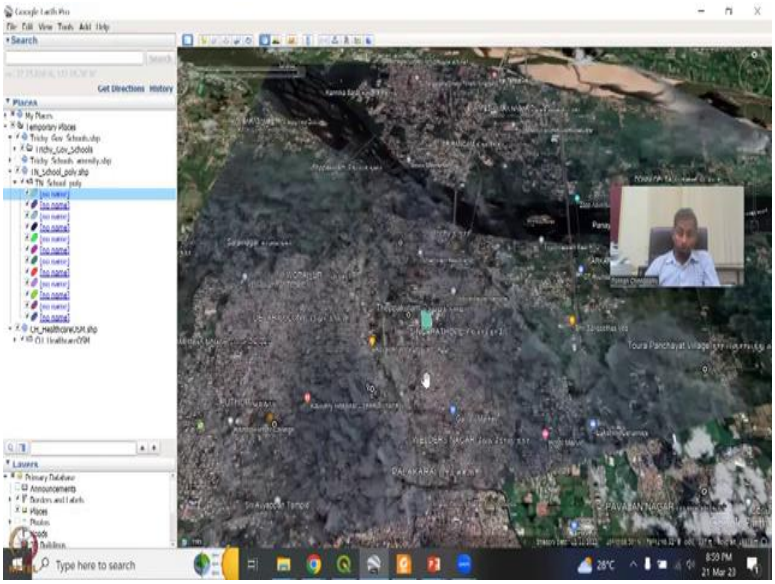
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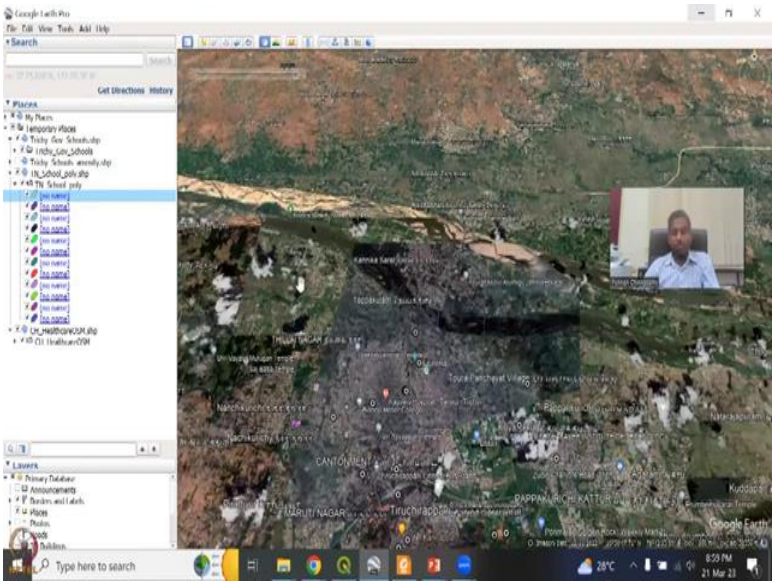
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Let us give an example. We may be able to take a smaller school, just for the sake of an example. So this is technically along rural areas. All these are agricultural land, you can say. And I am going to make the color a little bit, go to the properties, style color, you can make it opacity is 100 percent let us do 50 percent.

So, now you could see that Amritya Vidhyala in Trichy, is the school it looks like a boarding school with a big campus, badminton court, but along a village entity, and then there is a Urachi auditorium, which is kind of like a village region, Marbell encoil is there. So it does look like a village because of this agricultural land, I am saying.

So, most of this agricultural land is there, all these water bodies, and then you do have a lot of temples around. So, houses are also not very close, which is like urban centers. So, this could be a definitely more of a rural entity. I do not know why this motor school is also labeled as a school, we can see the properties just to say, it is Saint Francisco School. And then there is an archery so maybe boarding schools normally would have bought an area outside because it is lesser, costly, and then do it.

So, let us this the other thing, I wanted to show that you can do a time series analysis, and to just see like how the school was developed, or what was there before school. So, here I say, I could see that all of this was agricultural land. These are agricultural land that had happened. And before the school, there was pure agriculture happening, you can see, that all of this agriculture, but then they bought these plots, and you can see exactly that maybe these plots were from a particular owner, these plots were from a particular owner, so they merge these plots together to buy a land.

And then the school has been built. So in 2002, the school was not there. And, again, land use land cover change, we say 2007, the school was not there and then slowly the school construction will happen 2010, you can see that land is being cleared. And still some agriculture's happening here. But slowly as a school is developing, and the land is developing, you can see that it has been occupied for the school premises.

So, this is one of the reasons where you could have a better use of GIS and remote sensing to look at a particular school, how it has evolved, and most importantly, what is the coverage? How many villages does it covered? And is it good for you know, covering the entire region for school kids, so this is also kind of a rural entity with less number of housings. I am going

to push it to the current, so it says Kaveri global senior secondary is when it says global, it is not government.

So, it could be another private institute. So, looks like a lot of these schools have done well in in terms of having you know, international names and or having a big campus for, for more targeted to the populations of urban and Bishop Heber is there, there was a very, very famous school. A lot of people in the villages do commute here. So we do have this so I will stop with the school part here. Will quickly run the roads for Tamil Nadu again, or at least it is a Trichy and will overlay it here to show how these are connected to the schools.

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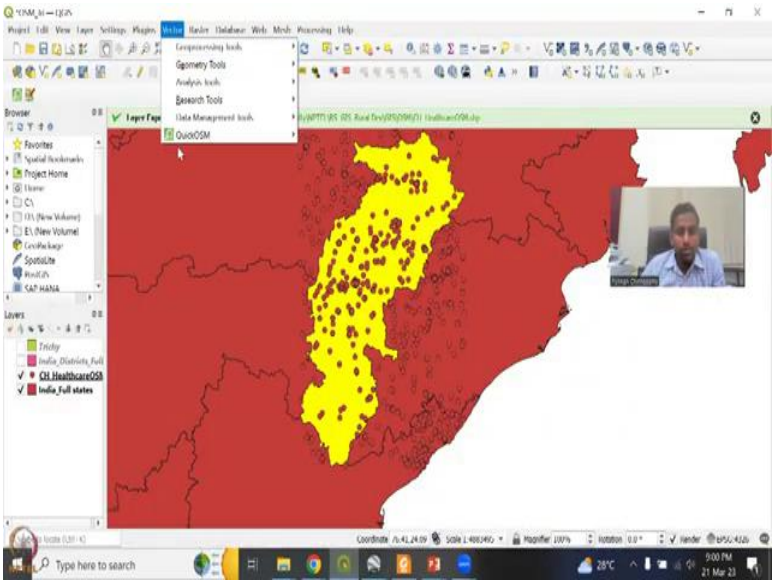

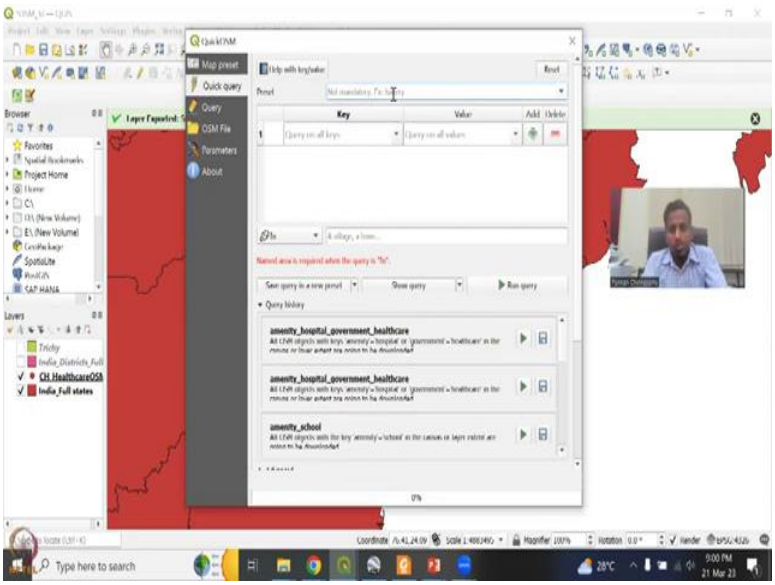

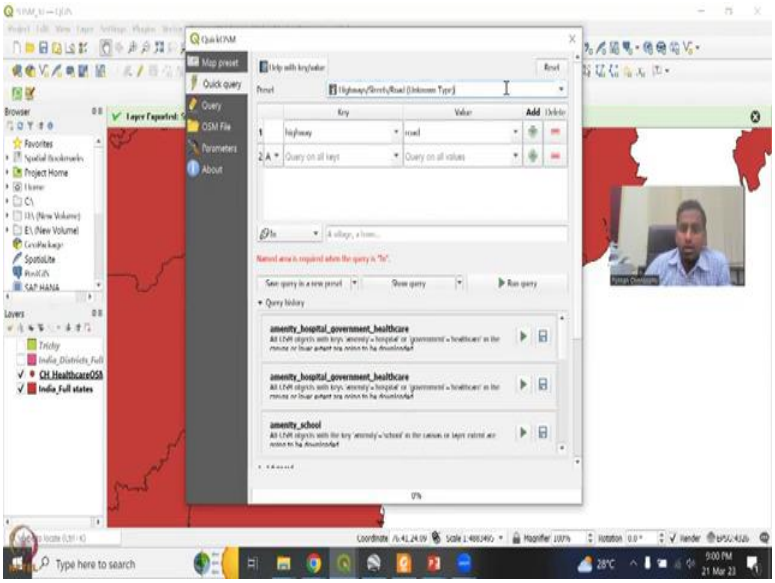
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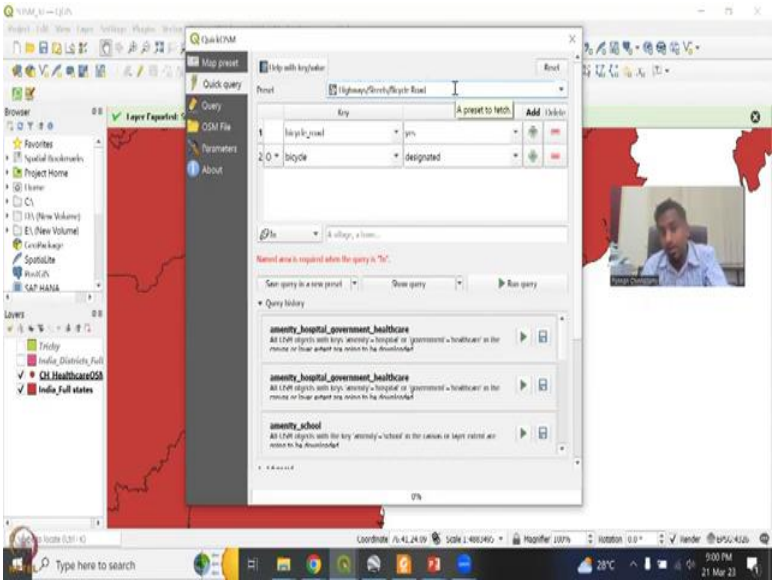
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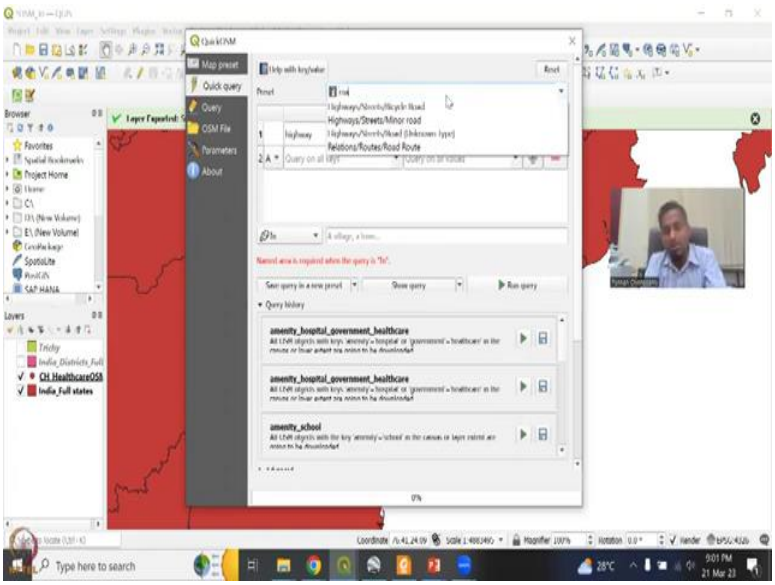
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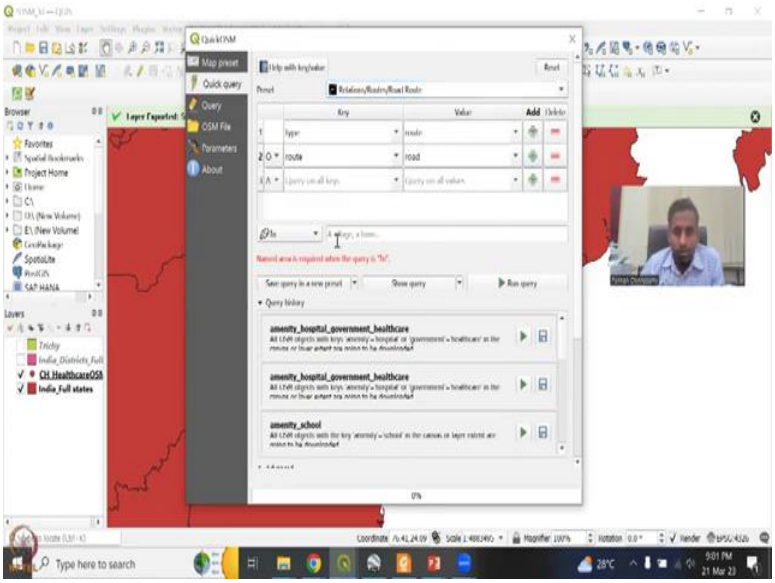
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amenity_hospital_government_healthcare
amenity_school
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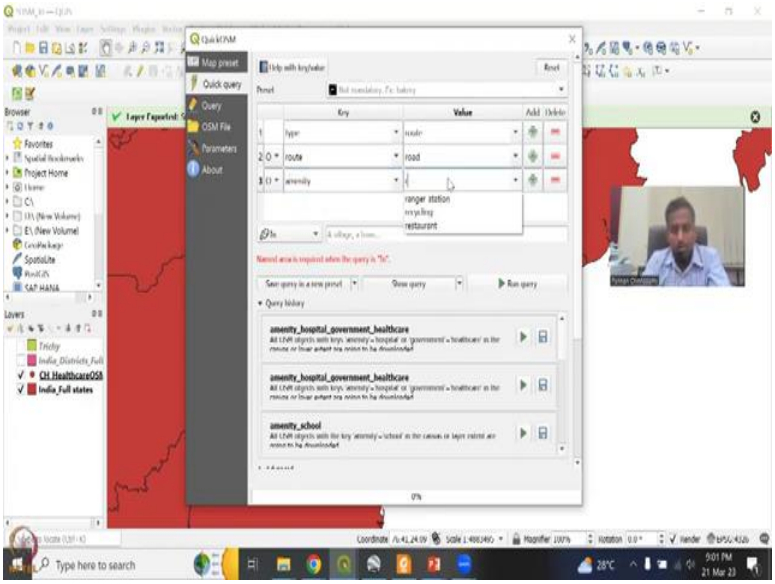
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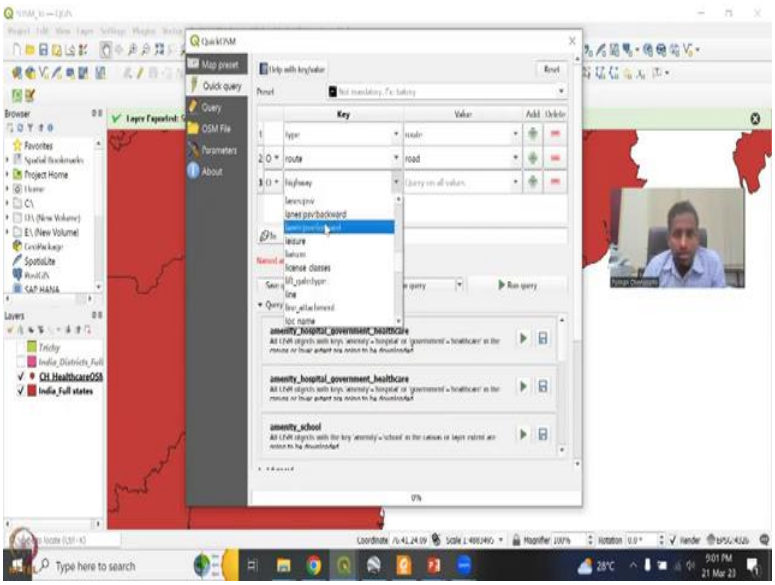
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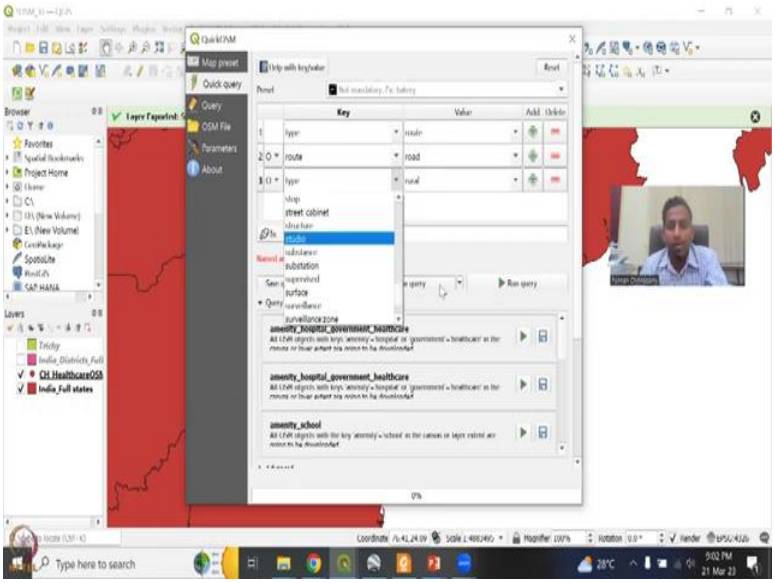
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amenity_school
Advanced
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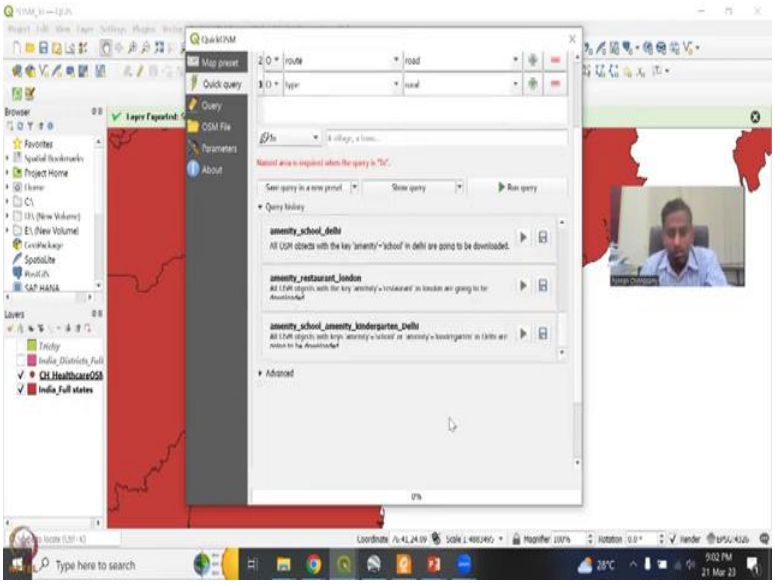
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Query
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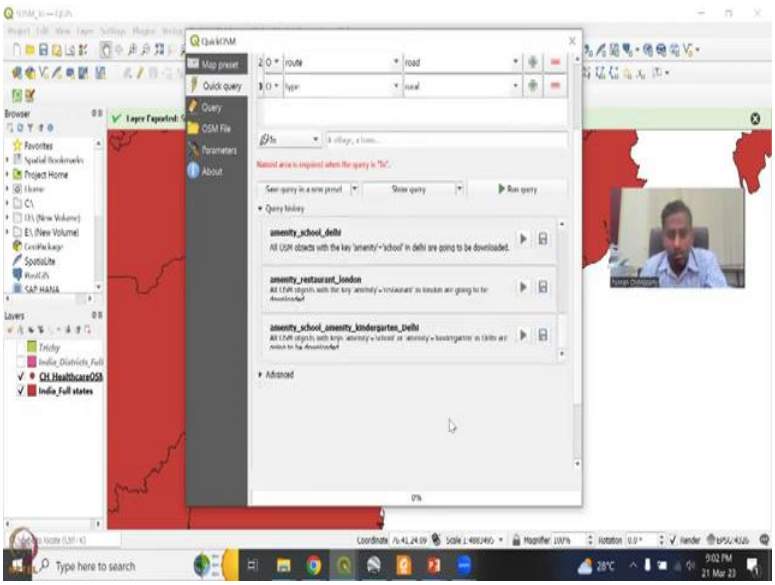
amenity_school_amenity_kindergarten_delhi
Advanced
Type here to search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Advanced
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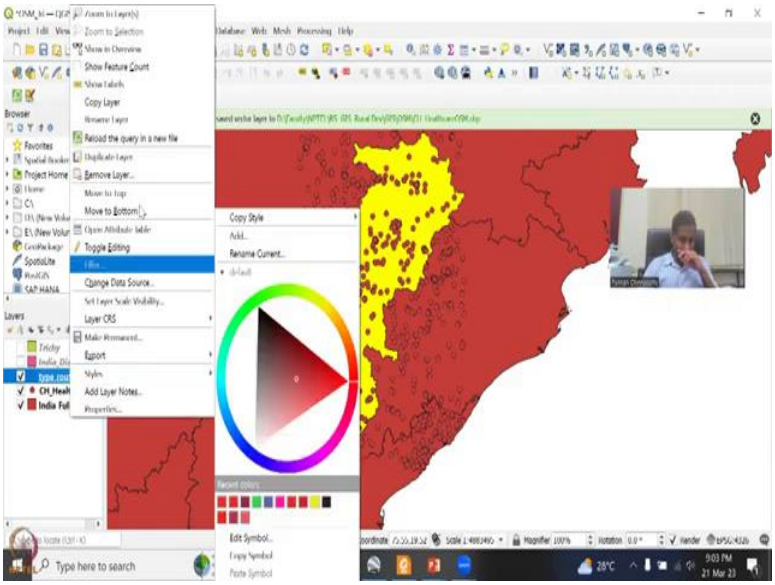

So, I will keep the TN schools and the TN government schools dots here and what we are going to do is will go back to Google Earth open our vector plugin click OSM and then will say roads, let us see what comes up, roads. Just say roads and it will be highways streets relations roads type unknown type is there good. And then you can add you can say some other road types. Let us say bicycle road is important for you know, the small pathways for mostly Europe but here also small path ways are called bicycle roads, minor roads we want unclassified is good will add it and then will also when we do the preset again and again it will it will overwrite it.

So, let us see if we could add a road so we have added one, one more or so type is road type is route road and then I am going to do amenities and is not there, will do an or community and when we say road, highways government so we say road. So, we do have small roads and small things in type so maybe we can say type and the road is already there, it will not come highway rural. So, for some reason, all the roads types are taken out. But it is good. I think we already had this as a query.

We do have school's healthcare; we have bank. So, this this should be okay. So, type is road, type is road. We could have someone as highway. So, just a case. And then what are the values in highway, you have bus stops construction site 2 ways, emergency ways, quick ways. So, in these things, we have links roads, let us keep it as roads. So, we have RRR and then as I said will do a layer extent of Trichy and let us run and come down to say that in advance I need lines, not nodes. I do not want nodes.

I do not want polygons; we just see if lines are available. Because roads is a line or a pathway. I have run for other places just as a backup. Because as I said the quick OSM has just been updated. Yes. Good thing we have run it successfully one layer has been added. This is a merge layer of all the 3 searches we have. So, all the three will be there but as a merge layer. So, let us zoom in to that layer.

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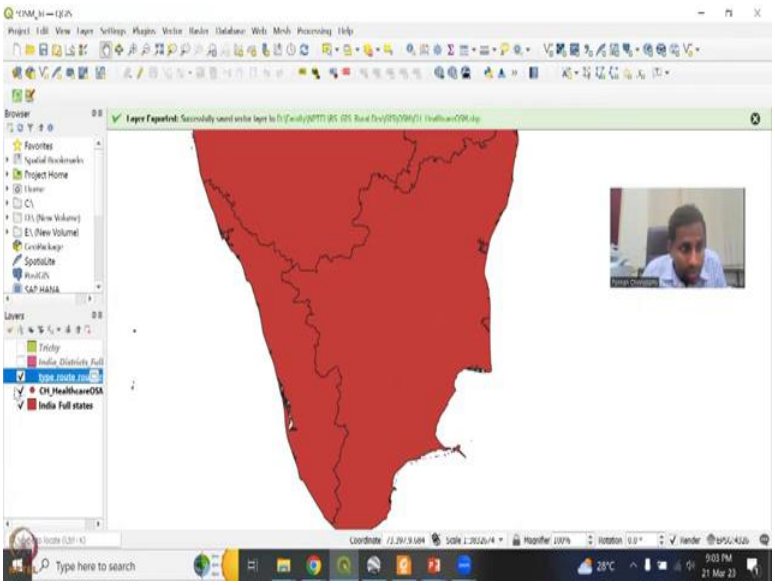

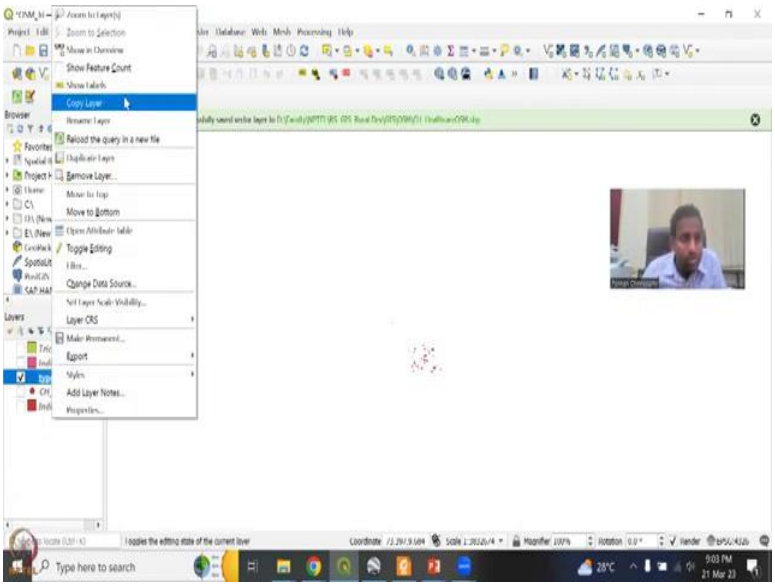

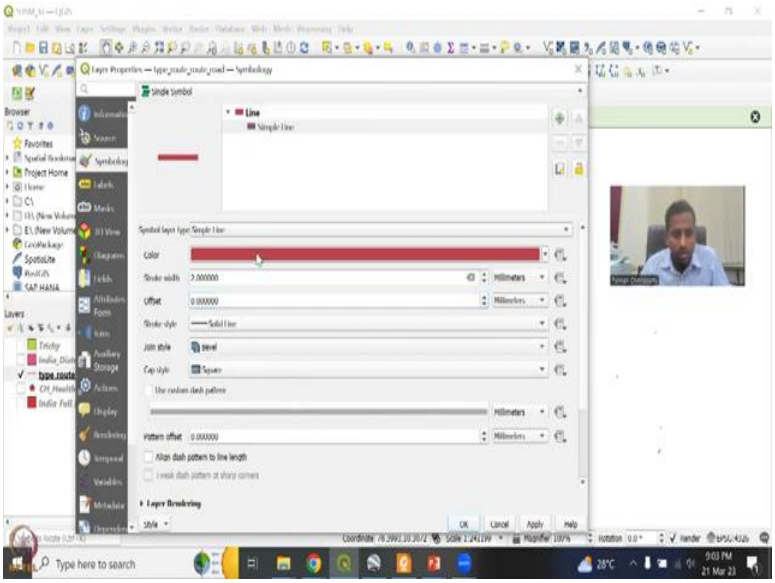

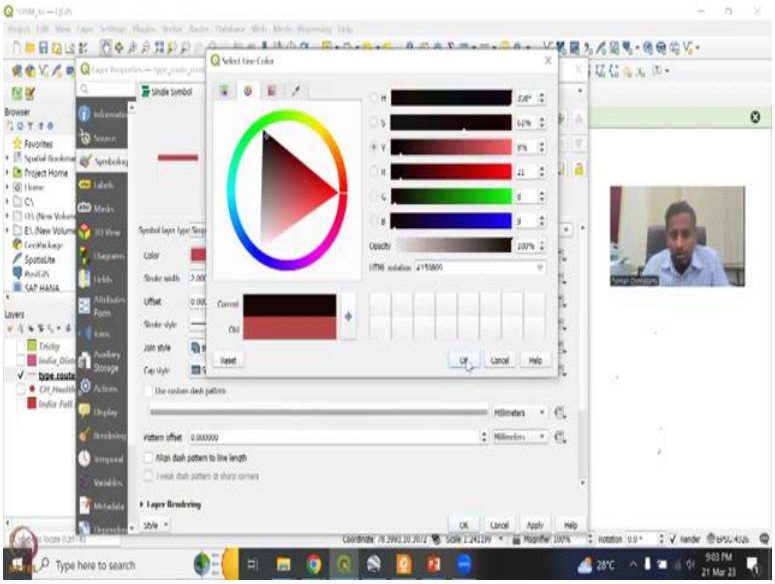

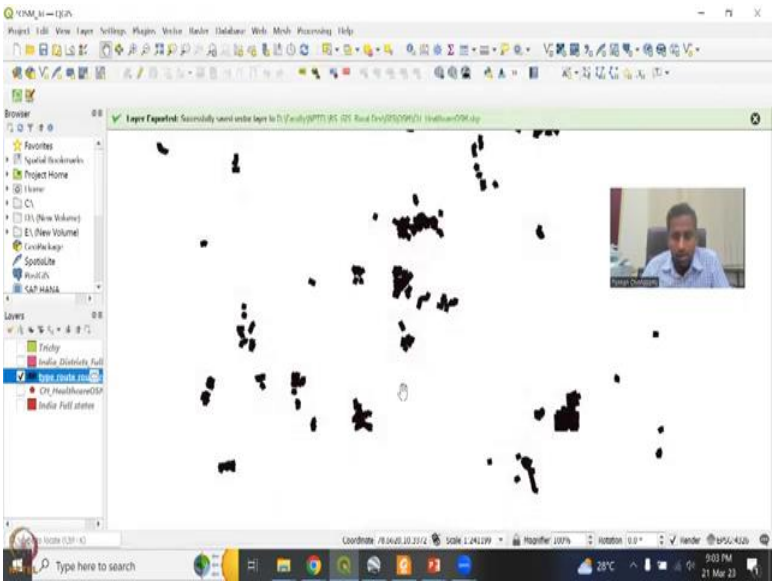

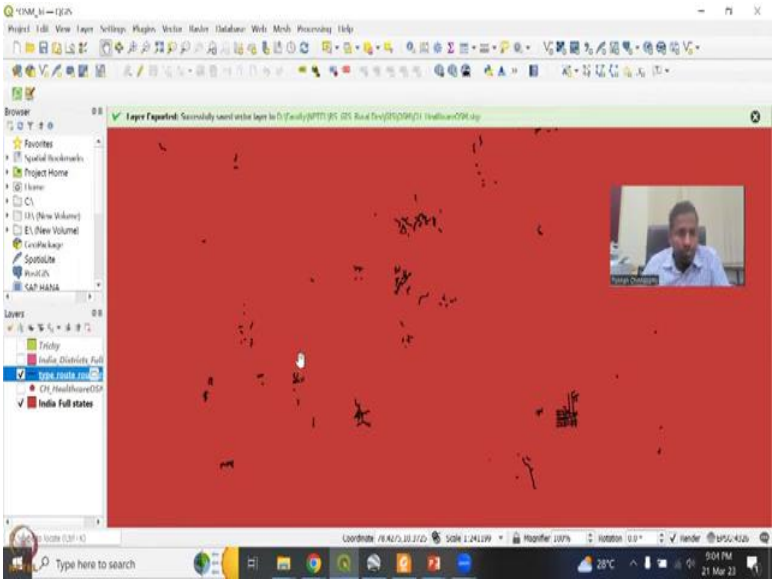

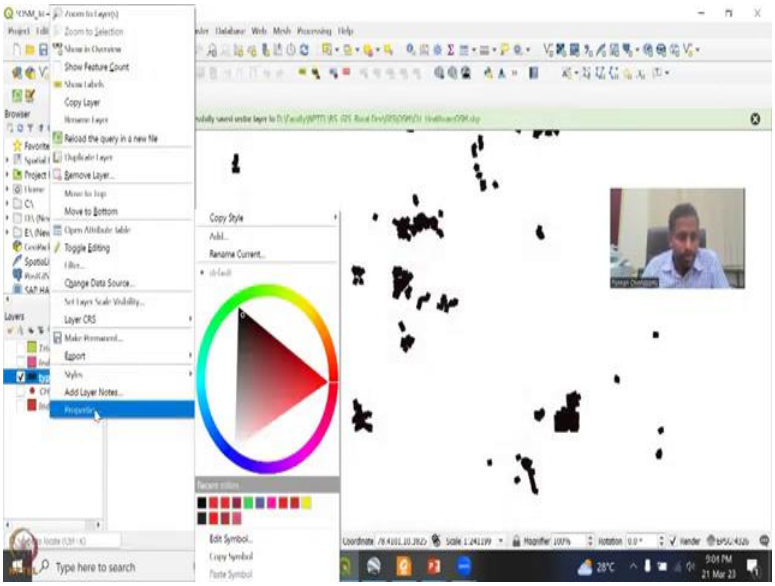
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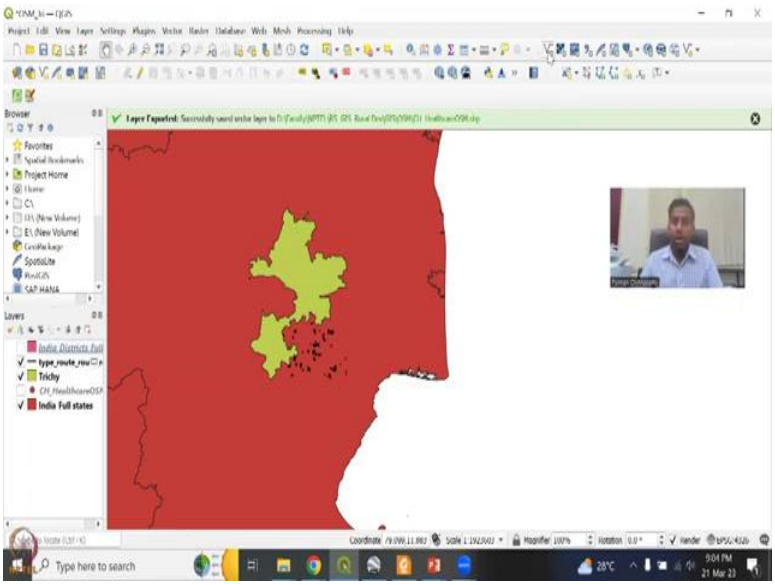

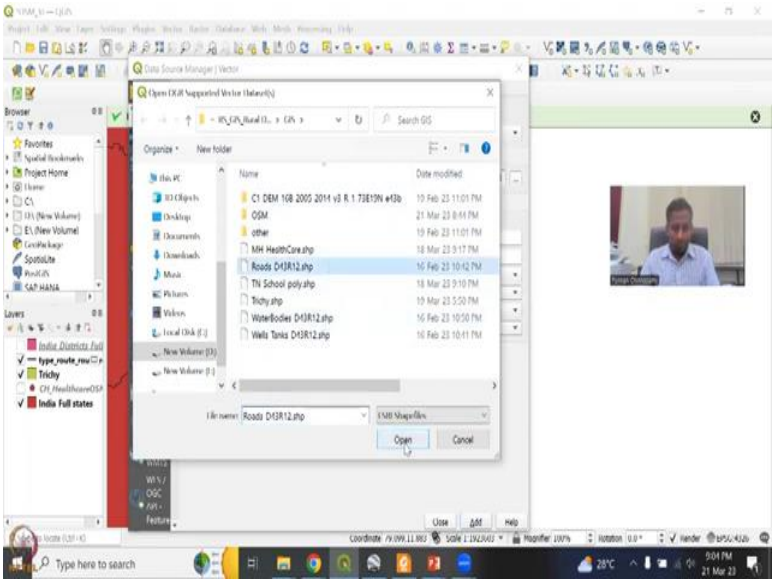
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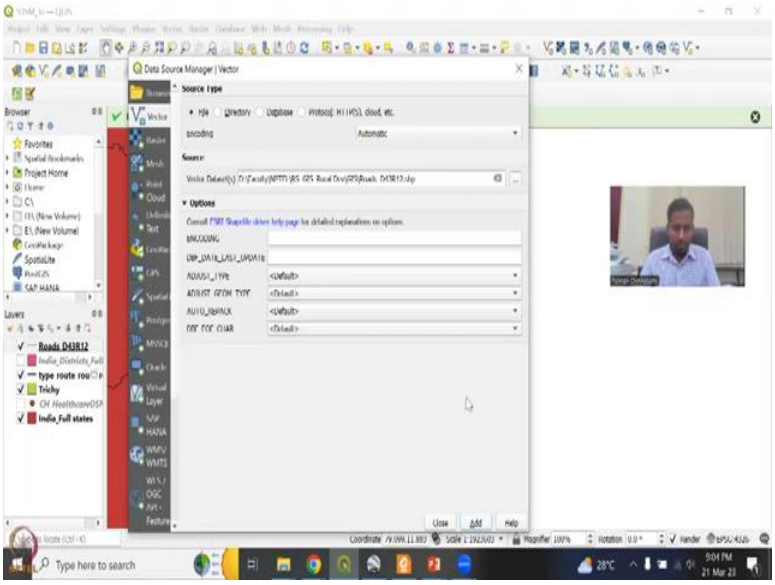
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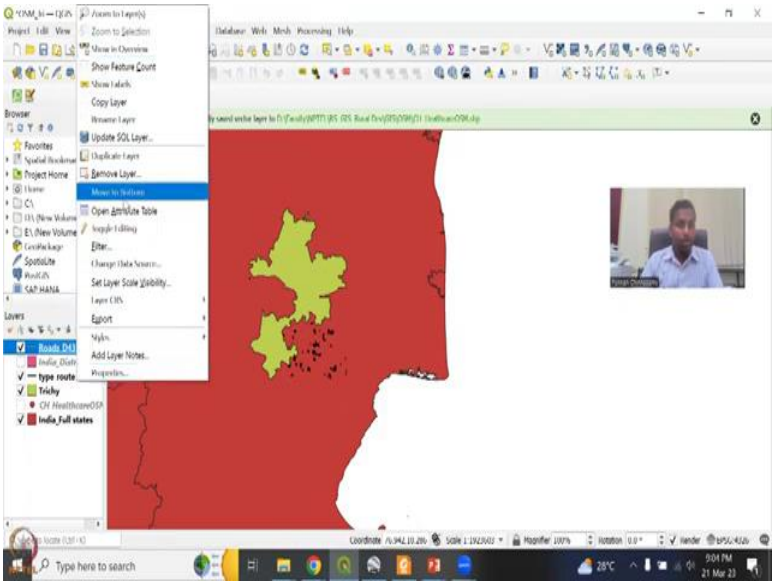
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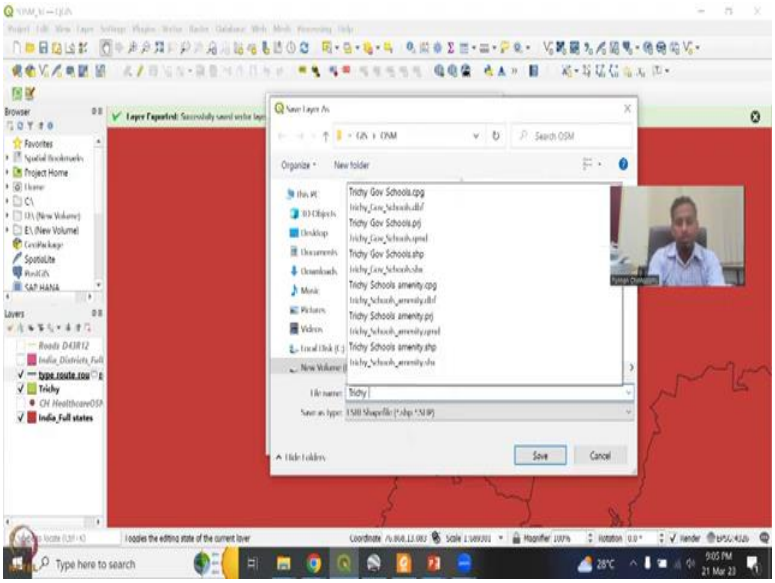

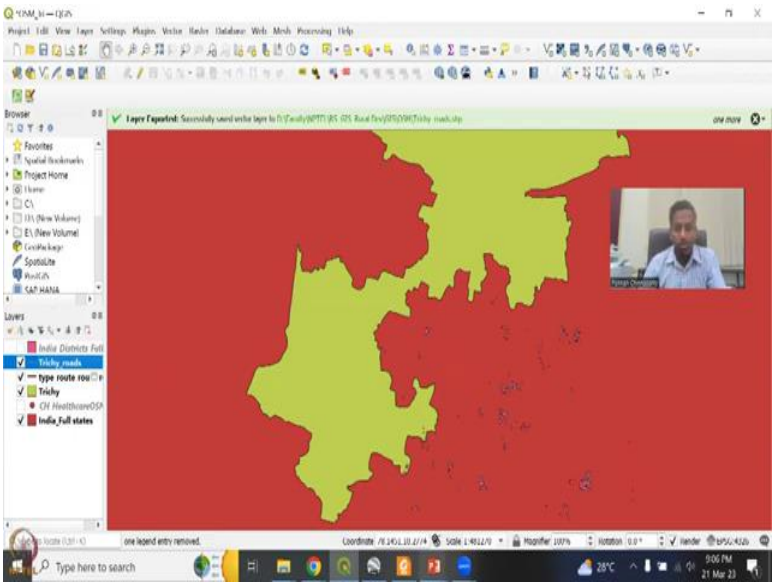

And you could see that there has been zoomed in but I do not see the lines. Maybe we will see the IRFS you see that so these are the roads for some reason the color and the symbology is too thin. So, will go to simple maybe stroke is two and then the color can be black because we do have a lot of apply, properties 2 to point 5 okay that is good. Okay apply that is good. And now if I put Tamil Nadu you can see more. So, this is only in Trichy. So, these are only Trichy and it is certainly not Trichy alone but some parts of Trichy.

So, it is in and around Trichy it is not capturing the rural roads. So, this is where I said infrastructure and road mapping is very, very key. We do need to have it. So, I also added I have done an exercise on roads. So I just add it, then this is particularly for a thing that we did initially highways and stuff, you can zoom into that layer which is we if you remember we

did this for a particular place in Maharashtra and Karnataka part where we did a geo reference and image and then we extracted the data.

So, like that also you can add the data, this is from that lecture where we geo referenced tile, and then extracted the road network. But we can also take highways and other aspects as and when needed. So, there you also have wells and tanks that I have done, which is water bodies. So, someone was asking for surface doors and water bodies, which we will be looking at. So, for now, as I said, we can select this road type, move it to export, save features as, go to OSM my folder, then say maybe Trichy roads or space, shaper added to the shaper, remove these layers, you do not want these layers. And then Trichy roads, we can also zoom. We do have this.

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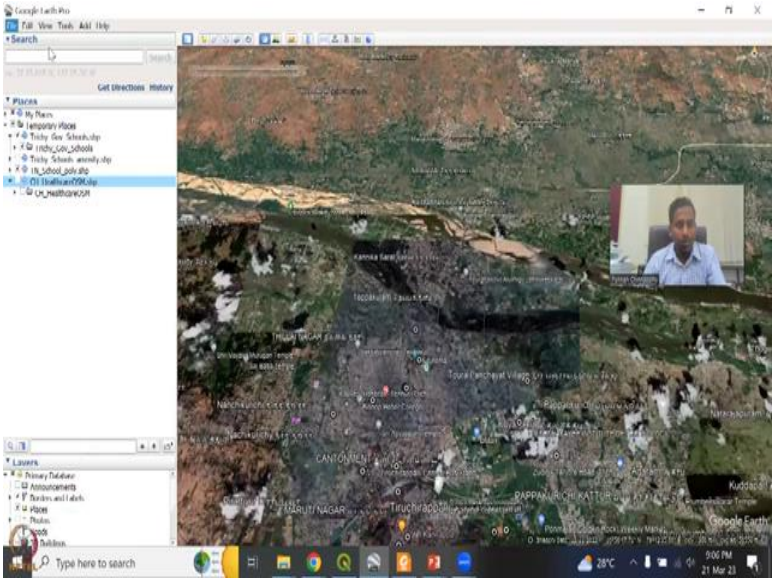

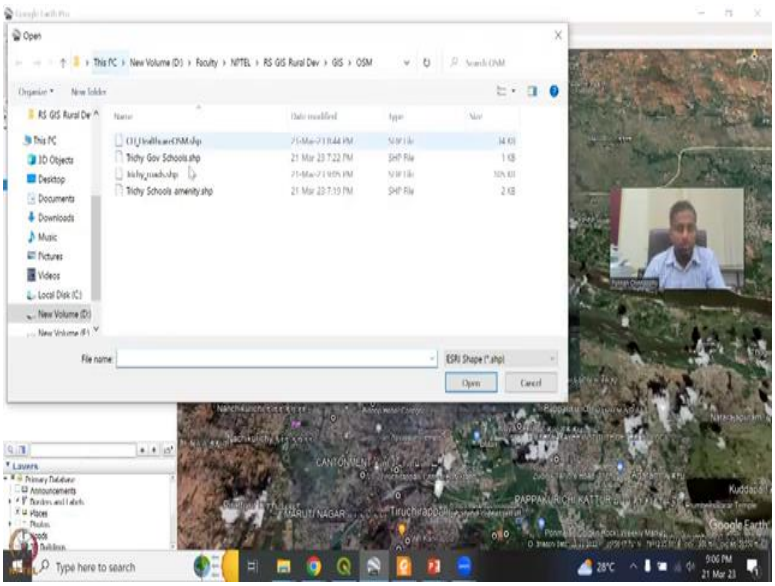

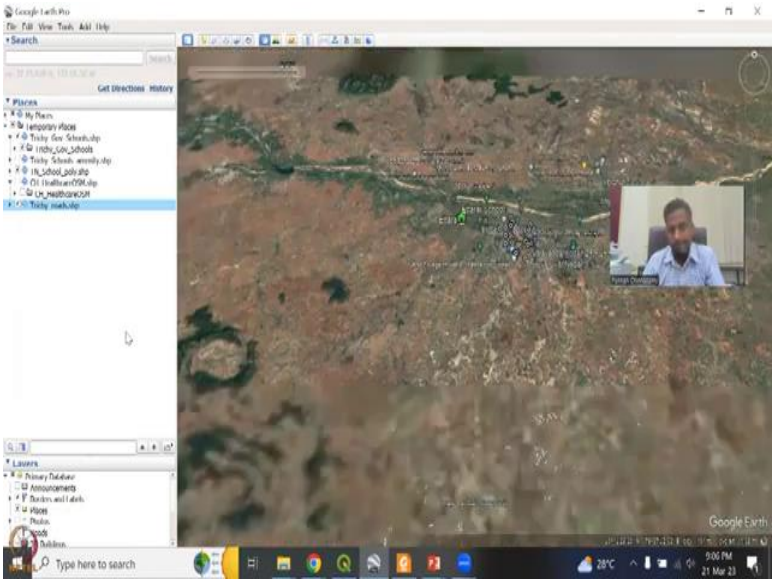
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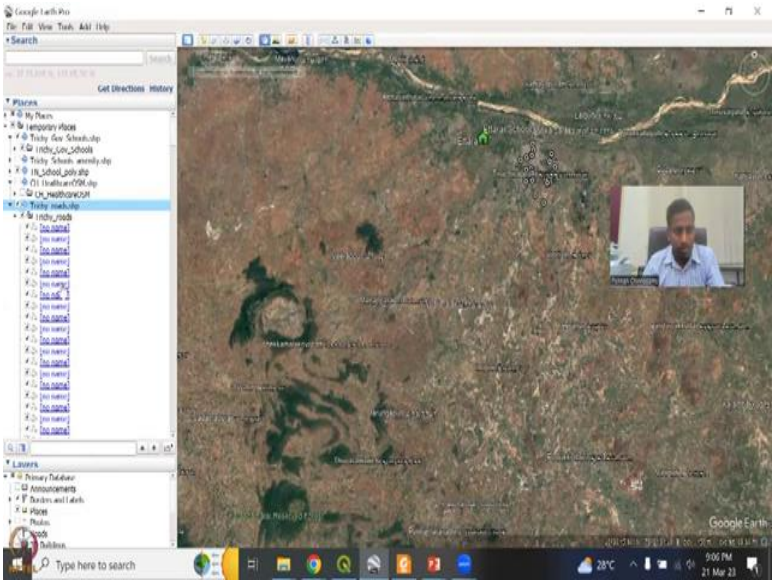
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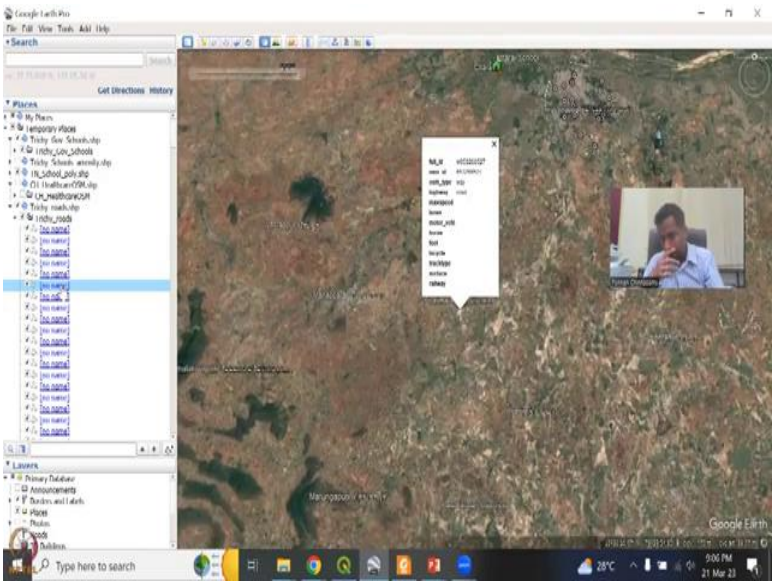
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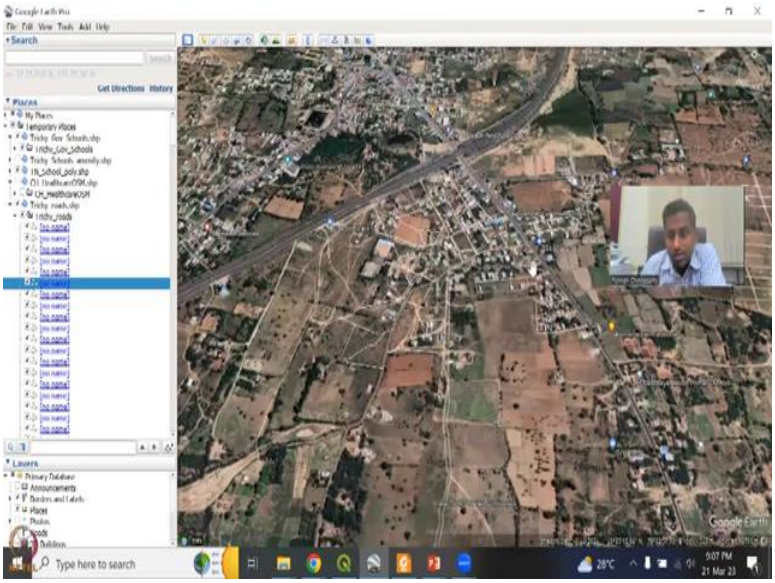

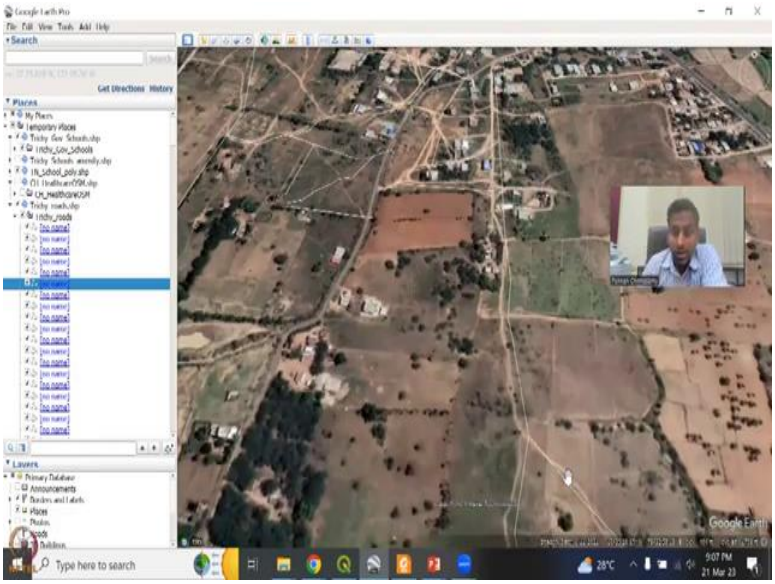

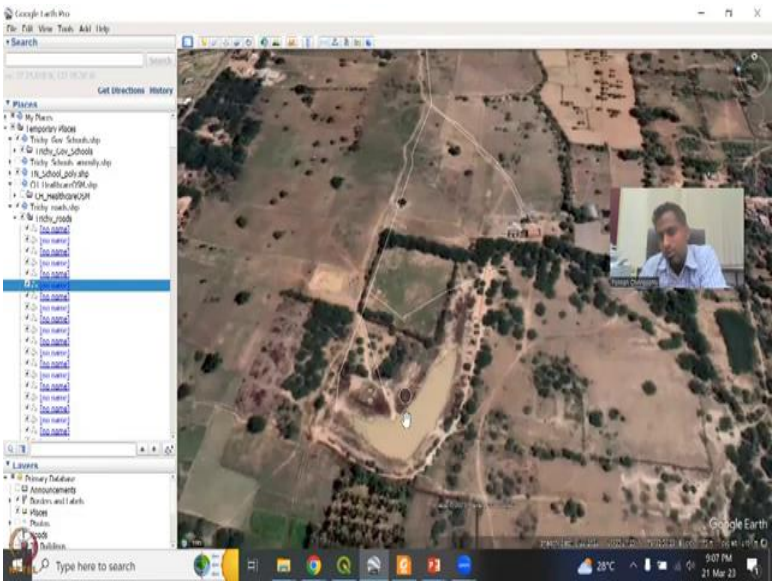

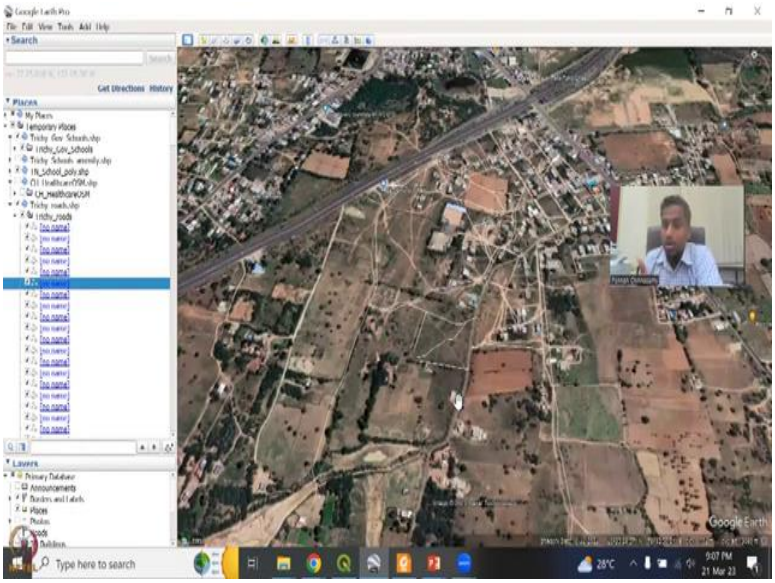

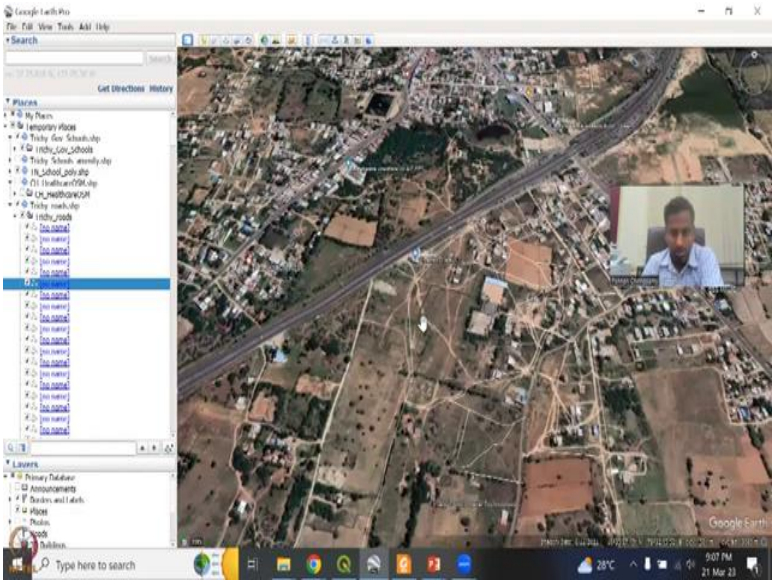

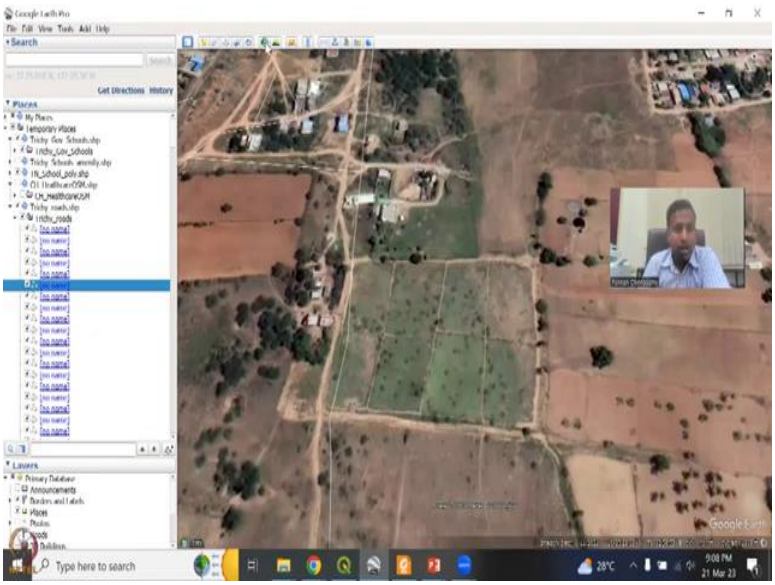

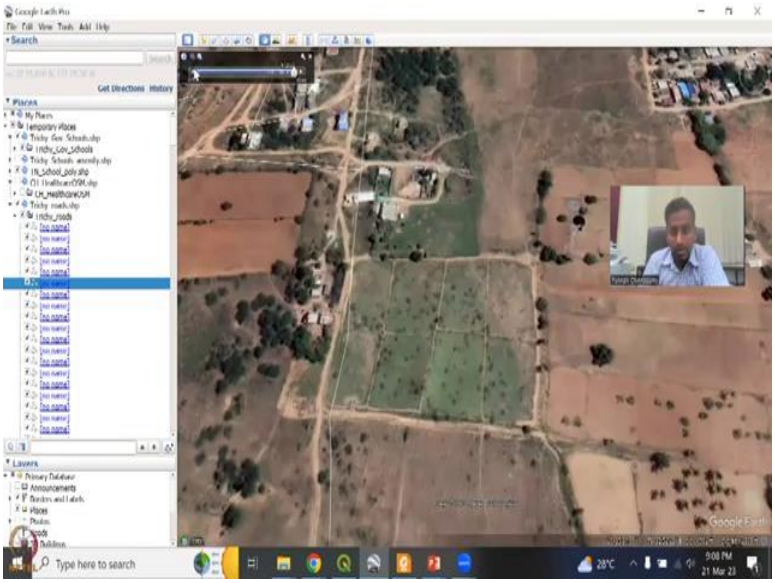
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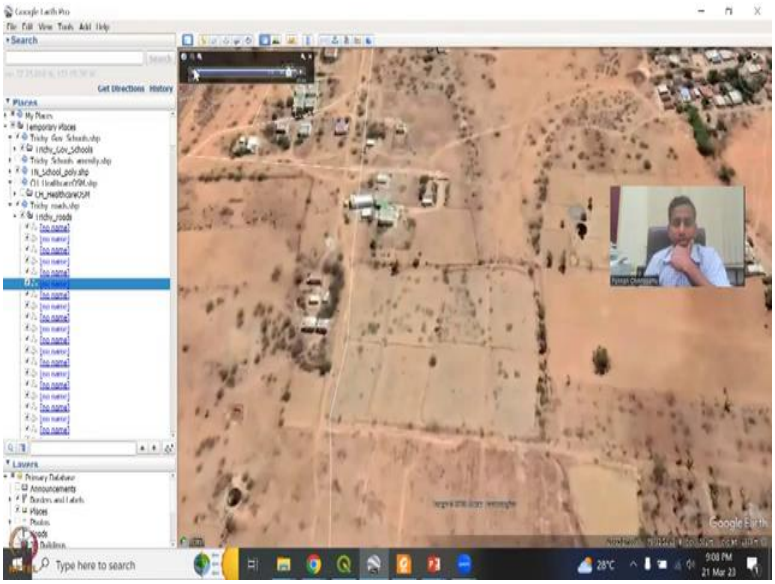
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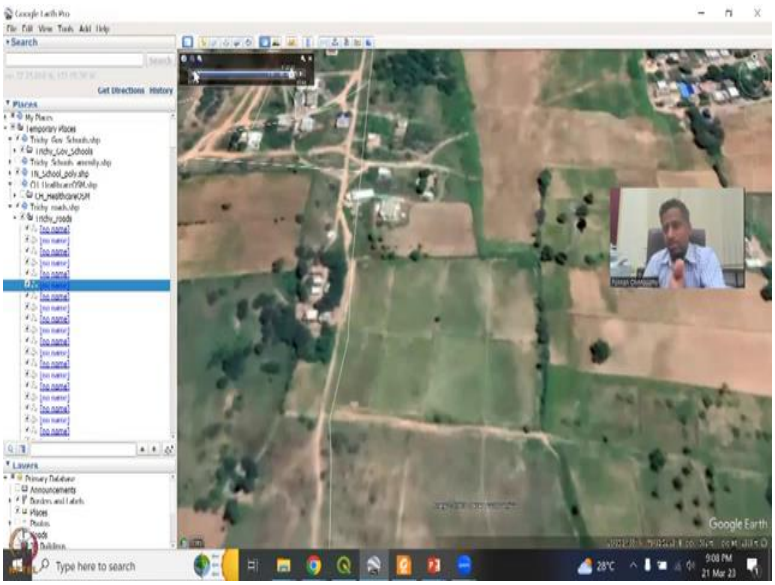
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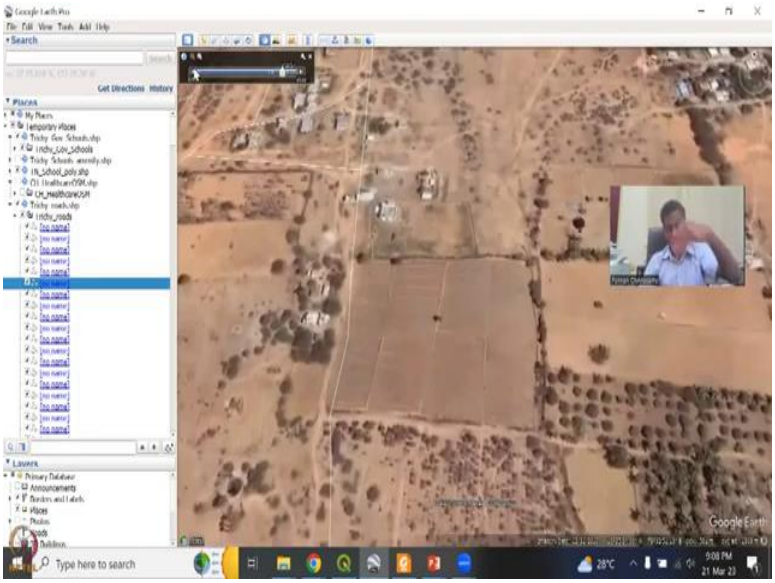
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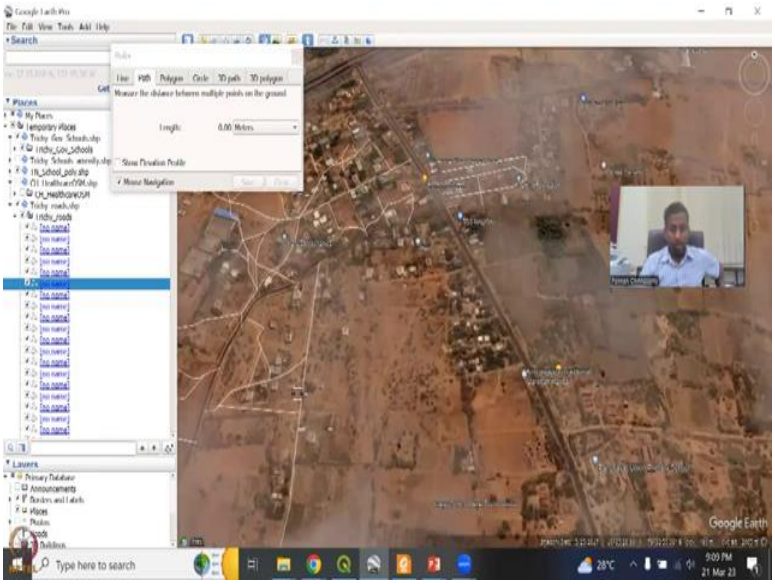
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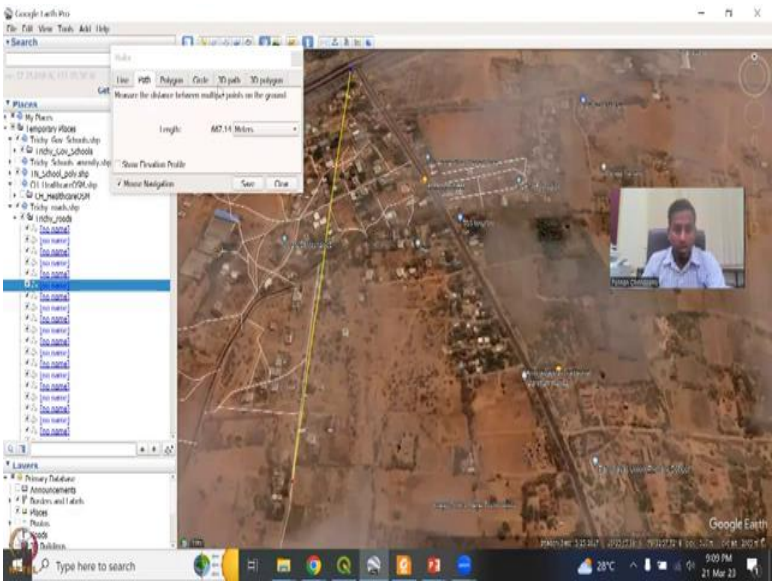
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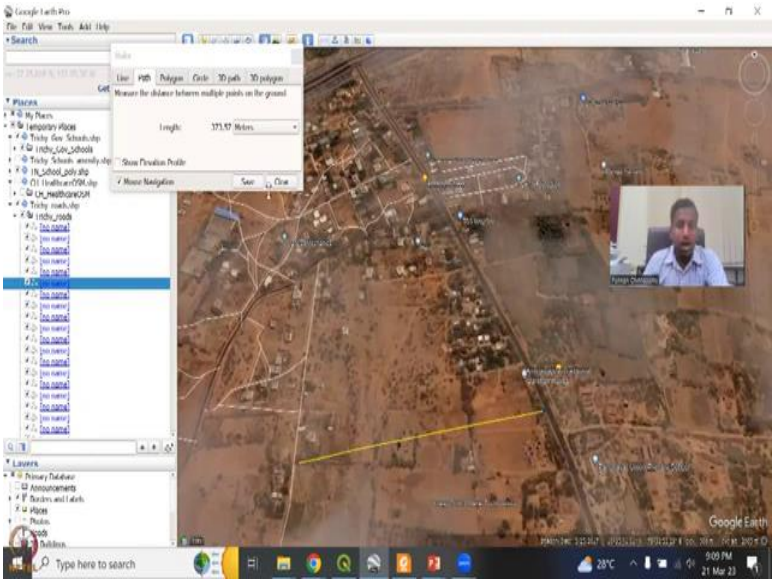
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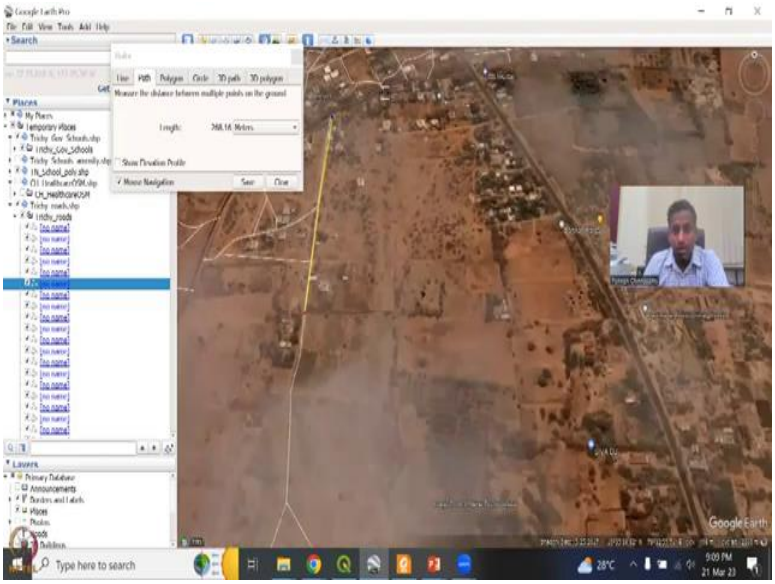
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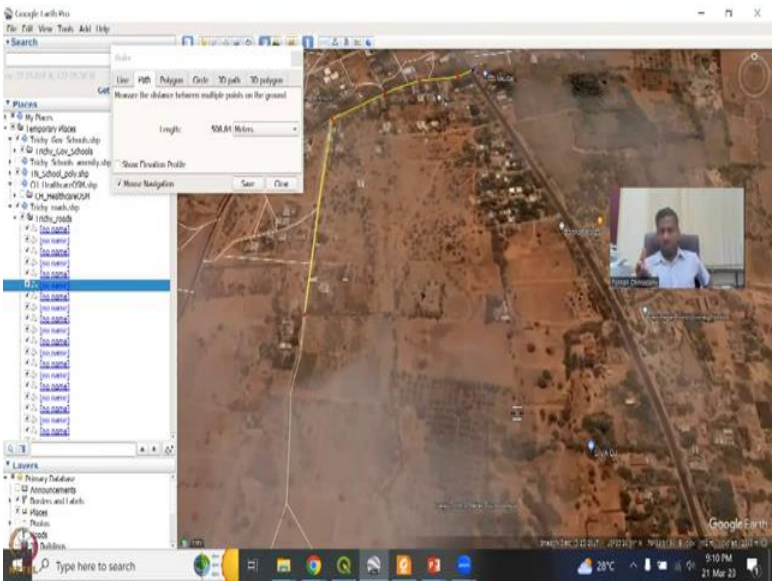
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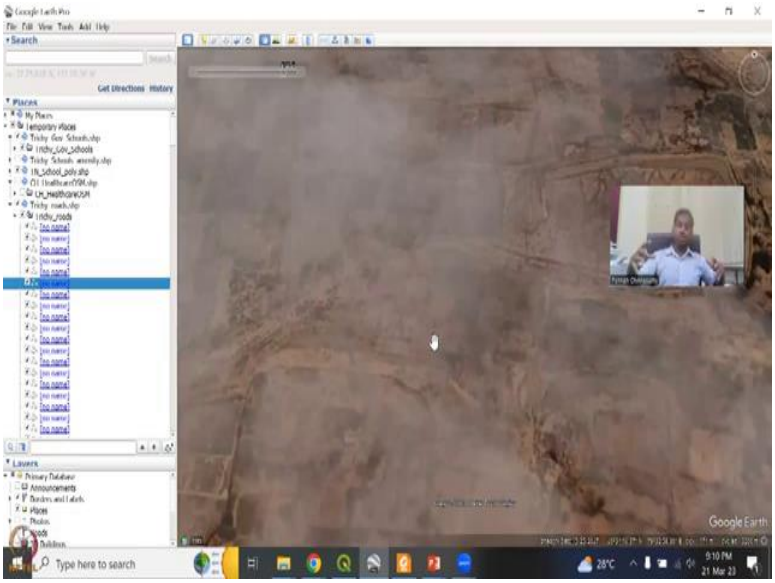

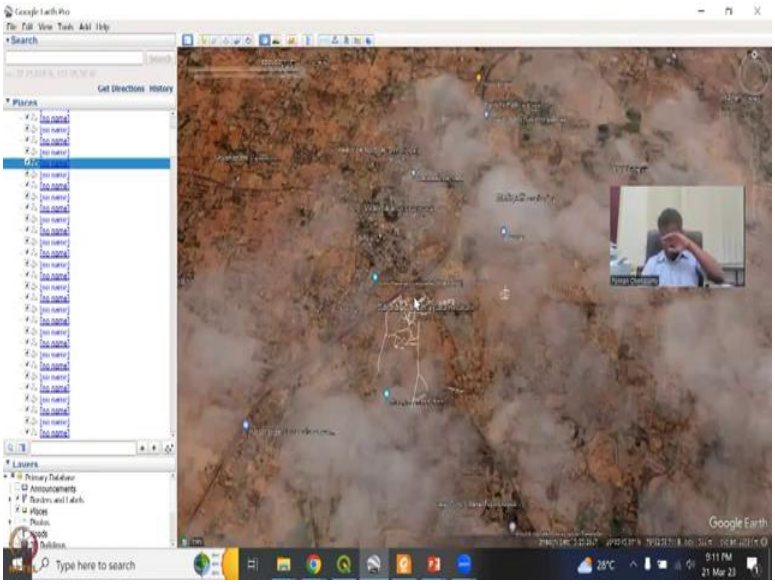

It is a good thing will open in google earth pro file open Trichy roads, open, you want to use it the same on that again, view, reset, tilt. And there we have it. So, I am just going to open this so that you can see the individual polygons polylines. Let us click on one. Yes, image has a lot of clouds. Will remove this, the best lines come up, you can see how beautifully and this is a village area.

So, you have this road. Three among 2 wheelers is the highway. And there is a road through the village I am saying village because of the agricultural land, you see the land divided into parcels. It is not accurate. However, it is beautifully there because it goes through the system. And it is actually dividing even to the small lake and pond, they have a road. So, someone has actually meticulously driven a bike or something.

So, you can actually do it as a bike layer, you can click on a ways point and then click, click, click or a path on an app and then collect the data. Again, there is multiple videos on how to collect waypoints. Once you collect the waypoints, you can export it here into OSM. And then there is a beautiful layer. If you can see clearly these are not these are not your average roads that are laid with track these are mud roads or non-matte roads.

But these are very important. I will show you why. Because when you go here, I say for this path. So, this farmer is growing this land, I hope he is growing we can definitely look at the images in the past to see yeah there. So, if we can find a growing season, yes, it is green, definitely there is growing something, this is a summer period, post summer, not out of rainfall do not have crops. Yes. So, you can see the rows the rows and all cut.

So, that is a cropping. So, now if the farmer is having a small crop and in this image we had better view of these crops. So, there is a crop now the farmer has to harvest it and send it to the market and the market everything is dependent on this road connectivity. So, the good thing here is from here, we can quickly estimate the time to go to the highway and which is the best route. So, from here you can say this will this will take around line and path.

So, from this plot, you can say through the highway if the roads are connected, you can go through 600 meters, or if you say I am going to clear and then say from this to this straight road is 3 400 meters. However, it is not straight, you will have to go through a path. I will show you why. Because it is not connected. So, now you have to use a road and say okay from here to here, there is a road and then from here you have to take this road this road this road and then go to SS Maligai and that gives you 600 508 meters 100 meters extra but you need to incorporate all this on the travels the budgets the time.

If you know and been in villages you will know that how fast you get the produce to the market, the price is different, especially flowers. I have been taking flowers when I was a kid. So, when we take flowers in the village, quickly, they will ask us to collect the flowers and give it in a bag and the bag is being transported to the market. So, early market price let us say a kilo is 200 rupees the flower as time goes up the same kilo of flower goes to 100 rupees.

So, you are the farmer is at big loss, he will take 10 kilos day and all the losses there. So, this is how the connectivity does keep very, very important aspect for rural development and livelihood and more on that the profit margin is changing. The second aspect I also wanted to

say is if the produce is quick, so this is just a small thing, a road that is connected very near very near 600 meters to the highway. But think about a lot of other options were the cropping is here, example here and the road network is not there.

So, they have to go through the mud roads and then go to the highway it takes more time. Let us say it takes 2 hours to get to the highway and from there it goes. So, all throughout this the crop let us say a fruit, like Kiwis or other things that are okay let us say smaller foods that everyone uses let us just say tomatoes. So, tomatoes may get damaged and the damage is a loss for the farmers. So, this is where if the road network is not their rural network connectivity for the farmers not there. There is a loss in time and livelihood options.

So, with this I will stop here we today we have looked at hospitals, healthcare and roads. We can also look at how the same analogy can be used for how the hospital is connected. But for now, most of the hospitals are in the city in the OSM database. I hope to see more data being populated, especially after this class on the hospitals in rural villages. I will see you in the next class with more on crop mapping and agriculture. And then we will call OSM and over by weekly. Thank you.