Advanced IOT Applications
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Lecture – 38
Air quality: System design - part 2

So, in summary you have to finally, your problem will be you know down to the fact that how do you chose a sensor for your application right. So, I have tried to capture the important points that you may have to look for before you start looking for this sensors.

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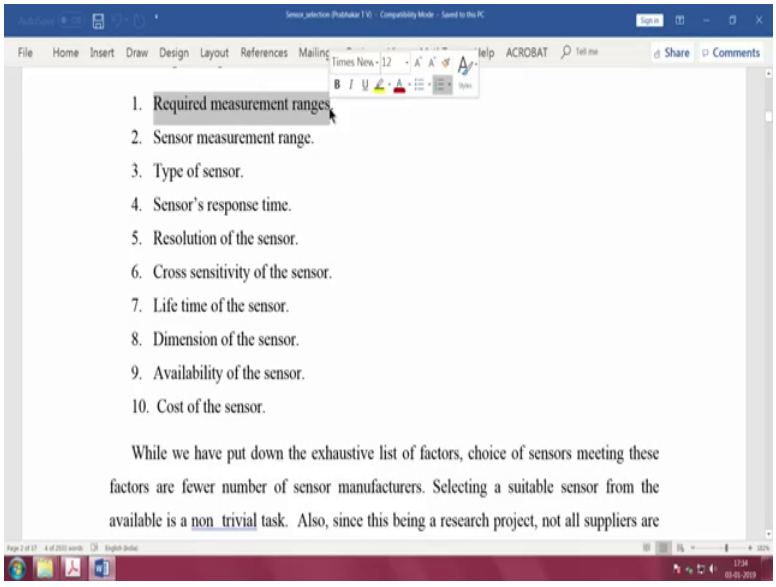

So, some of them are here I have just listed them; required measurement range you need to decide, sensor measurement range that is you have a requirement of measuring something. This is what comes from what you want to measure and then you have to map what you want to measure to the sensors that are available and therefore, each sensors measurement range; this is mapping requirements to availability of components essentially 1 and 2, the very critical thing that you have to do.

Because sometimes linear curves may work sometimes multiple multi linear may work multivariate linear regression may work sometimes log plots are what you get. So, you may have to look at the log plots given out by the vendor themselves. So, or may be linear to some range and after that overall becomes very it may become non-linear by behaviour. So, you are keep this things in mind on how easy it is for you to calibrate and

recalibrate and keep the systems running for long time that is one thing; then the type of sensor of interest because that will also be driven by the cost right.

Electrochemical you know for sure they are much much superior compared to the semiconductor sensors in terms of the linearity of the sensor itself is concerned; so, they are very good. So, that is one sure short reason why you may want to chose electrochemical, but at the same time lifetime of the sensors are poor the shelf life is one part and then once it is gets starts getting used you know starts you start using it you may have to frequently replace them that is another problem.

Also there is the problem of sensors response time then resolution of the sensor; cross sensitivity I mentioned to you so many times now be very careful about it. Lifetime of the sensor, dimension of the sensor; depends on where you want to place a of course, availability and cost or something that you will definitely have to worry about.

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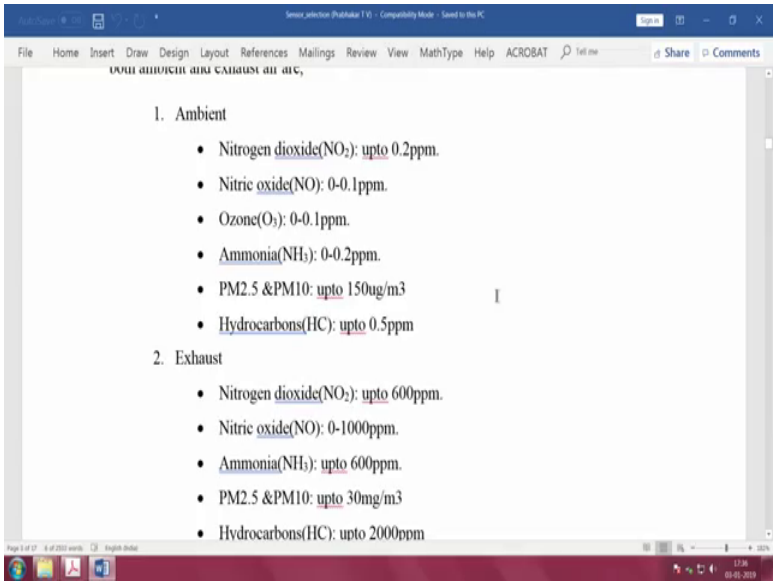

This is what we went about in our design by doing the same exercise nitrogen dioxide 200 ppb; nitrogen nitric oxide NO; we can see 0 to 0.1 ppm; ozone also in the 0.1 range, ammonia is 0.2 range 0.2 ppm range particulate matter 2.5 and particulate matter 10 up to about 150 microgram per metre cube and hydrocarbons up to 0.5 ppm.

So, there are similar numbers for tail pipe exhaust that you want to do and you want to go based on the fact that perhaps they are less cross sensitivity to other gases and therefore, you may want to chose it.

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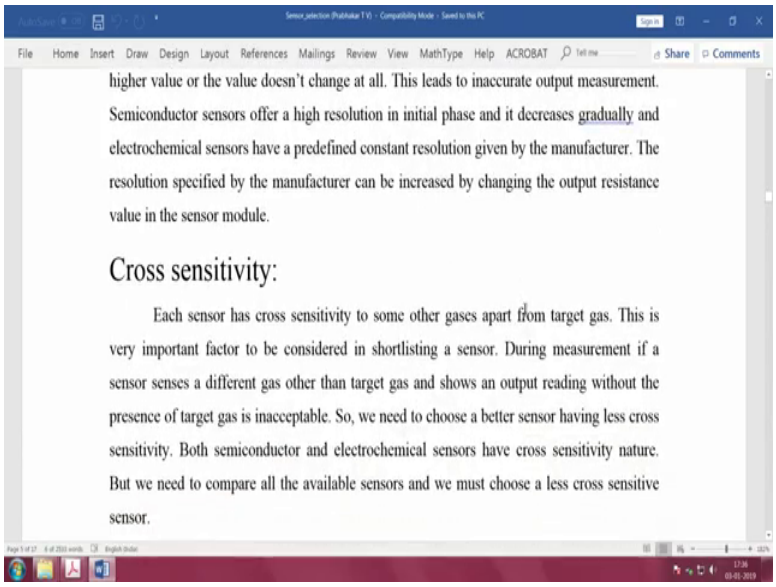

So, that is in brief what I wanted to tell you; let us now put down a nice demo plan for what we want to demonstrate. So, let us come to that point and for that what I will do is the following you may want to consider going into demo plan.

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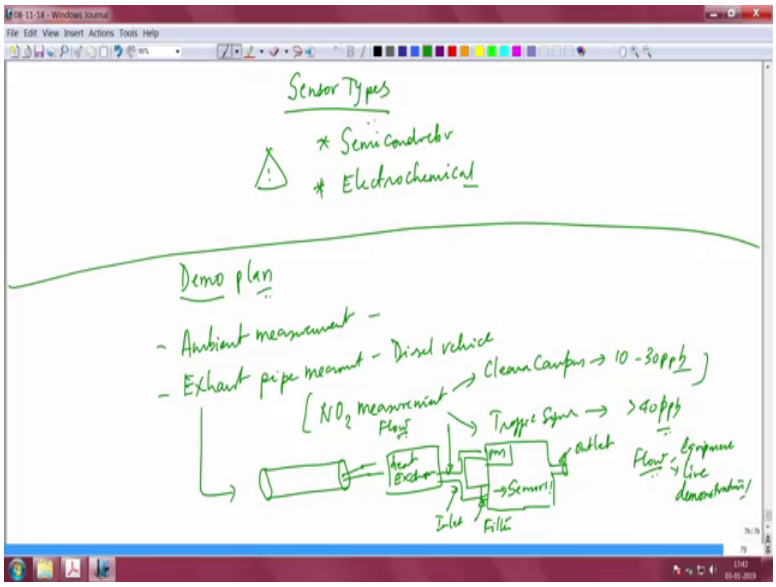

So, the demo plan should be something that will be you know useful for you in terms of catching your attention; on the whole measurement plan that we have. First thing is I should be able to make ambient measurement as well as exhaust pipe measurement exhaust pipe. So, let us take diesel vehicle and measure both together and I have given you the list of gases that you want to measure NO 2 NO and p m 2.5; p m 10 ammonia so on and so forth; all those gases of interest.

Now what we should be able to see is if you do an NO 2 measurement; just take an example, if you do a NO 2 measurement and keep it inside a clean campus; a clean campus clean campus, then hopefully you are less than you are in the range of 20 to 40 ppb ok. But if you do this in a traffic signal it should be greater than 40 much much greater than 40 ok. So, it maybe even this is even 10 to 30; I should say 10 to 30 ppb.

Now, this something you should be able to see; similarly when you do exhaust pipe measurement that is your instrumenting a tube just like the exhaust and then extracting the hot gas from that; passing it through the. So, this is your exhaust pipe actually it is round is not it; so, let us show it circular right.

Let us put a small pipe here and exhaust gases are coming pass it through some form of heat exchanger; why is this required? This is required because the temperatures of temperature withstanding capability of all this IOT sensors may not match the hot gases that come from the exhaust pipe. So, you have to put a heat exchanger; cool it down and then take it inside. Now you may want to measure particulate matter and through this another pipe; in fact, put a splitter here right put a splitter here so, that sorry right.

And we may want to put a filter here to remove all contaminants catch or trap all the particulate matter and allow gases to flow here and then we make all the gas sensors are here ok. And then small pipe here this is the; this is the outlet; this is the inlet to this chamber and you should be able to read all the values.

Now, how do you ensure that here the flow is maintained right. So, for that you need a calibration equipment to measure the flow. So, let us look up that equipment and then after that start with some live demonstrations.

Thank you.