**Advanced IOT Applications**
Dr T V Prabhakar
Department of Electronic Systems Engineering
Indian Institute of Science, Bangalore

Lecture - 31
Need for Air Quality Monitoring

So, let us now look at another IOT application which is of interest to us and perhaps each one of you have to work very very hard to make this IOT application a grand success. And so let us make this a very vibrant module with as many inputs as possible so that we all work towards the nation's life expectancy improvements. And therefore, I am sure you know what I mean I am talking about air quality one of the most important and compelling IOT applications you can ever think of when you talk about Air Quality; why am I talking about this.

So, before I started to look at this course we were working already on air quality and I can share some of the systems that we have try to build in collaboration with another industry, but that is one part of the story.

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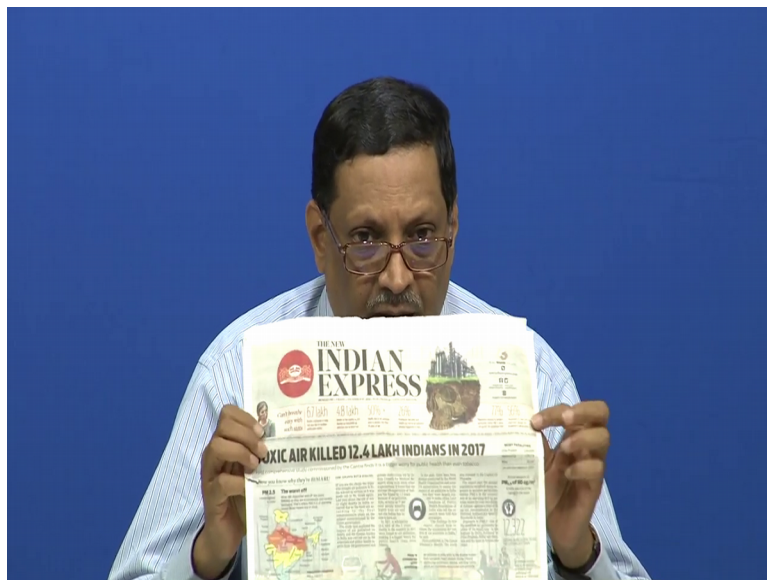
But in recent times the recent Indian Express headlines what really scared me you can see this it says toxic air killed 12.4 lakh Indians in 2017.

I mean it is unbelievable right that just because of no fault of theirs by just breathing the air that is free for all and somebody polluting it and we inhaling it our life expectancy going down it cannot be more sad than that. So, therefore, I can IOT solve this problem, can IOT monitor toxic air, can it tell you something about what is the quality of air right now? So, this is the problem the problem of air quality is not just confined to outdoor; please note this there is a problem of air quality indoor as well in closed spaces as well.

Think of the trains in which we travel what is a air quality in the trains? Think of the planes in which we travel what is the air quality of inside the plane cabin? What is air quality? Nobody knows this right no airline is willing to share it no railway board or no railway service companies ever going to reveal anything about what the quality of air that is available to passengers ok. So, this is in travel in transient when you are in different modes of transport bus, train, plane and so on outdoor is any way the another story.

And so this is a massive problem and unless you have cheap sensors which can give you very quick indications of what the quality of air is it; this is not going to scale up. This is very similar to some of the incidents that have happened where the nuclear power stations had issues and then you know you wanted to check the radiation level before going and doing any kind of repairs and service or maintenance of these nuclear power station.

So, there is no different right here that is a very small place you had you need monitoring you need to find out what is a safe radiation level and therefore, you will be able to enter. Quite like that air is also the same story what is good for you is known is already documented; how bad it is at the moment is what is the most worry something. So, that is the important thing you have to note.

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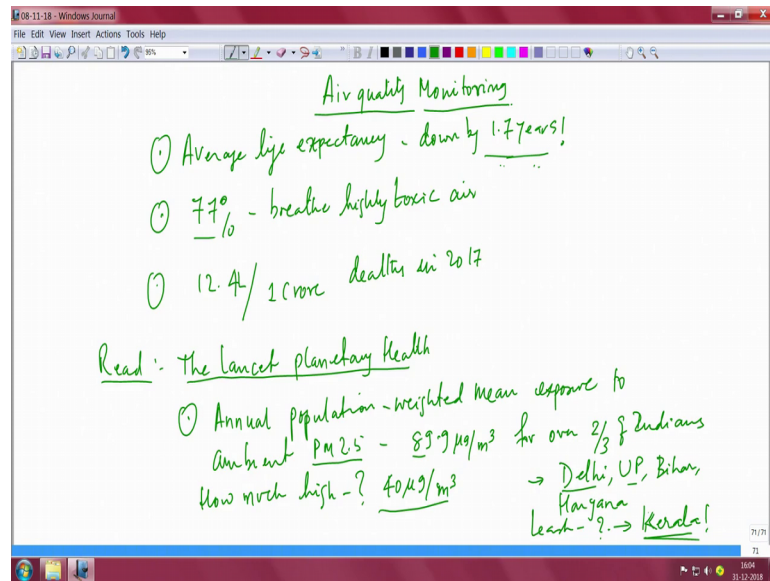
I put down the Indian Express survey in a one slide and then they show that the average life expectancy is down by 1.7 years and 77 percent of people breathe highly toxic air which gives us a very small percentage of people which are; who are actually not breathing highly toxic air you have to look at it the other way.

And 12.4 lakh, this is lakh out of 1 crore deaths in 2017 at least that is what the paper was reporting; they want us to read this land set planetary health article and I have actually try to download this article ok.

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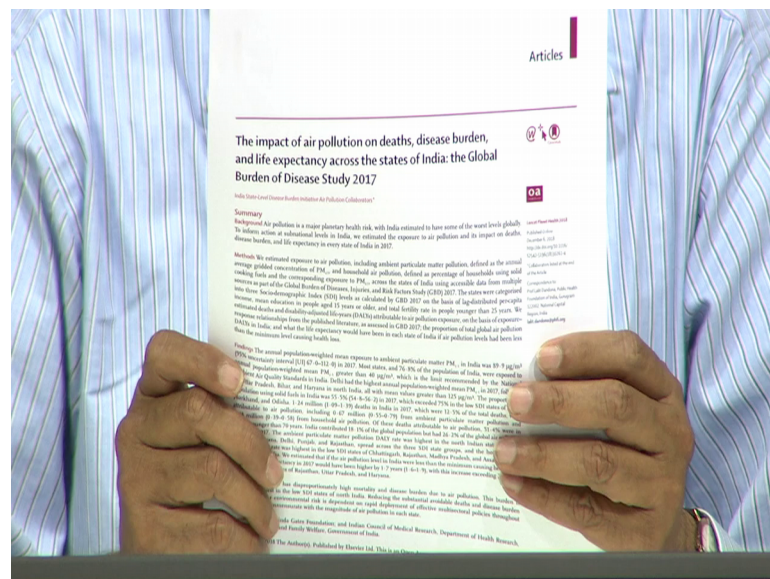
Its available on the web; you can see this is the title of the article. So, this is the article of interest it is here the impact of air pollution on deaths disease burden and life expectancy across the states of India in global burden of diseases study 2017. This is indeed the article which has actually been used for this newspaper article that appeared December 7th 2018 in the new Indian Express.

So, you can see the annual population essentially population weighted mean exposure to ambient particulate matter size 2.5 is 89.9 micrograms per metre cube right and this is for over two third of the Indians. Now what is safe is the question? How much is allowed? How much is ok? You are only allowed to breathe air which has just 40 micrograms per metre cube. And you can see this is indeed a roughly more than two times the; safe level of what the particulate matter should be. And so where is the problem? And which are the states which have the serious problem is Delhi, UP, Bihar, Haryana and which is the best state? Kerala which has the best air quality currently in the country.

Now, if you go into the details of this paper let me show you the some of the salient points from this paper. But before you go into the land set article I mentioned you about Delhi, UP, Bihar and Haryana contributing to a lot of particulate matter. Those 4 states alone the mean value is about 125 microgram per metre cube per particulate matter; so it is a pretty large large number. Whatever you say there are different standards for measuring what is safe and what is unsafe?

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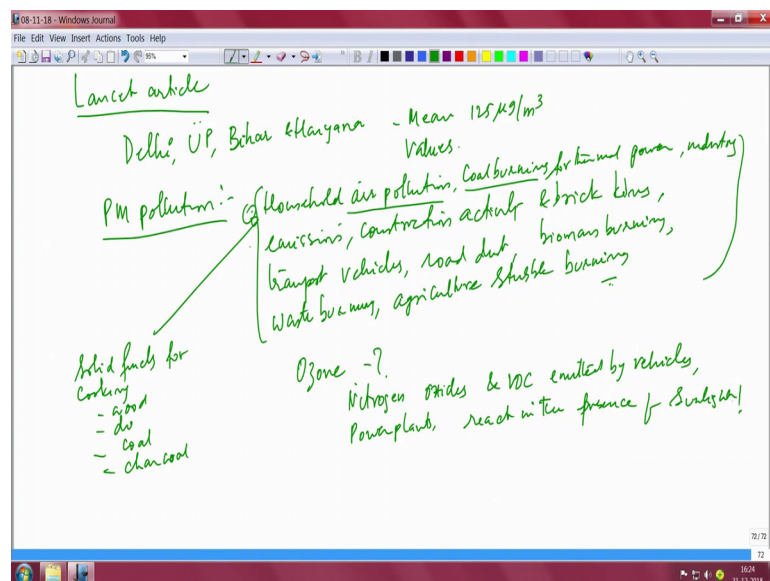
Now, question is why does it come? Why does this particulate matter at all prevalent in the atmosphere and why is it we are breathing it? It could be because of our own doing; in fact, most of it is because of our own doing take the household air pollution ok. Inside the house there is pollution we are the cost for that pollution why? Because the people in the kitchen you solid fuels for cooking; they may use wood, coal, charcoal by any one of them and that really is a cause for concern which is an primary source for particulate matter.

Then if you look at the industrial setting coal burning for thermal power essentially is another cause for concern. Because whenever you burn coal you will end up with particulate matter and that was what is an issue, but if you do not burn coal; you will not have power to support that is another problem.

Then there are industry emissions; then there is construction activity brick making factories; brick kilns that is another problem. Transport vehicles, road dust, biomass burning, waste burning agriculture stubble burning; so many causes for particulate matter.

So, the article actually a talks about several things how they collect data collection interpretation and all that, but you can see there is a big list of sources for particulate matter. Now is it enough if you monitor them or should you also try to understand how to control the emissions of these things; in whatever little way that you can ok; so, that is the point. Take the case of particulate matter what can we do? How can we reduce from in our own way using IOT what is it we can do?

That is what you may have to think about that is one part. The a next issue is also if you have seen in the chart there was ozone in it; we gave a number for ambient air quality and that was about anywhere from 0 to 100 PPB; where did this come about; where is this ground level ambient ozone?

It is produce when nitrogen oxides and Volatile Organic Compounds; VOC compounds emitted by vehicles, by vehicles power plants power plants factories and other sources react in the presence of; I will just say react in the presence of sunlight.