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

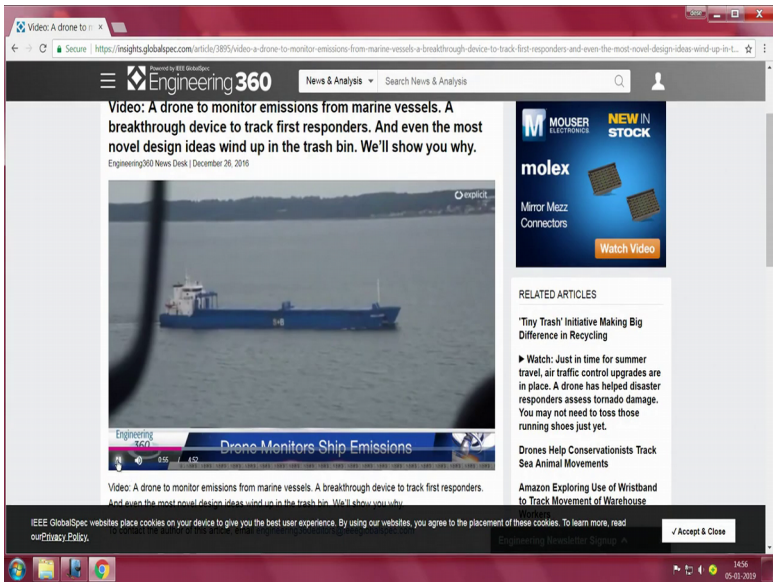
Lecture - 42
First Responders – Applications – Part 2

So, let us look at one more example which is easy you are just think out of the box, to look at where you can apply this first responder systems, need not be limited to buildings and in house fire outbreaks and so on. It can also be to monitor let us say emissions, which can be you know dangerous gases emitting from ships for instance ok. Sometimes, it can happen also that they are polluting so, much that it is you know completely unsafe for the environment around them alright.

So, now let us look at one simple application of a drone, which is we just discussed about the drones and landing systems and all that accurate landing systems to deliver your pizza for instance. So, how else can you apply these drones? It is a full one the full area of rich in problems and a lot of algorithms can be tried out in the drone platform. Nevertheless there have been people attempts that sort of go, in the direction of trying to use drones from a safety perspective also. Not necessarily from first responding, but also from safety perspective.

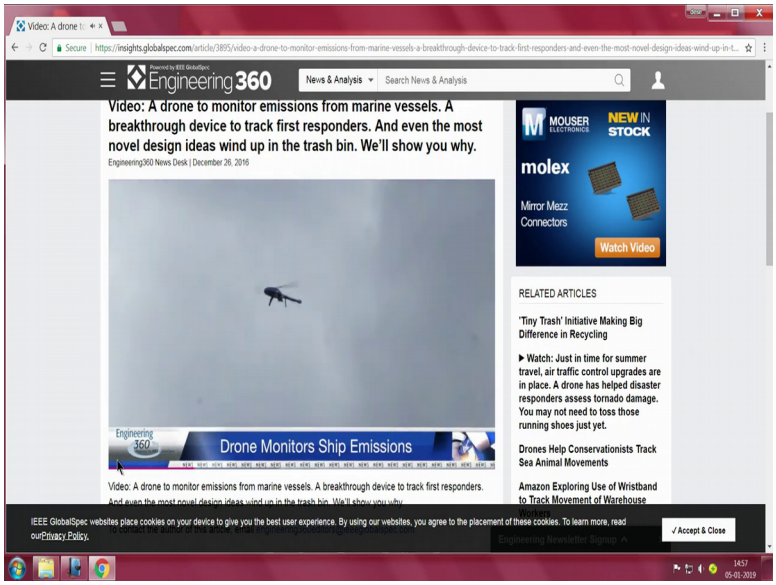
You can apply drones to monitor the emissions coming from a ship for instance ok. And, so just to show you how hard a problem, this is I have a small video clip, which is essentially focusing on the problems. I will just run the video clip and I will give you a background on what the authors have actually tried to do, which sort of gives you a feel for the hard problem that is in front of you if you work with drones.

(Refer Slide Time: 02:15)



So, this is a drone essentially this is a ship and they we are trying to monitor the emissions of the coming from the ship.

(Refer Slide Time: 02:25)

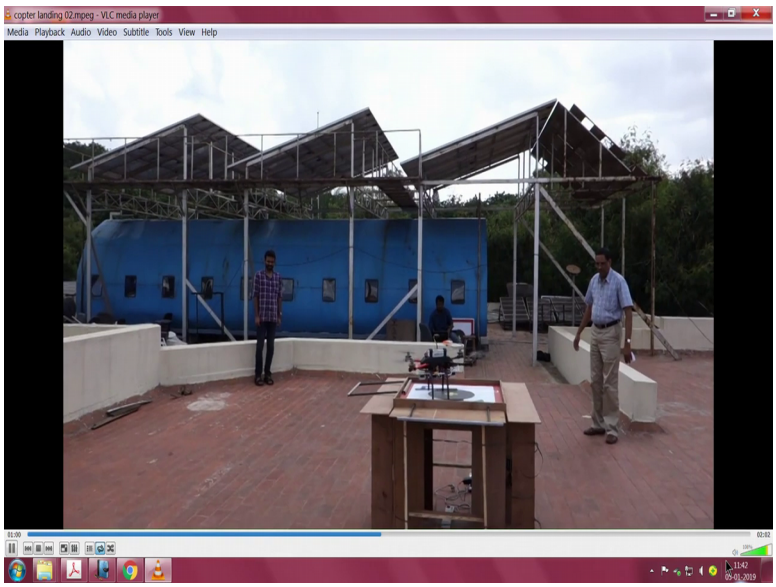


The drone essentially is capable of withstanding a storm from a wind, and it can fly 50 kilometres, non line of sight snow and salt spray, non line of sight, lot of rain, it can still work, go very close to the ship collect a gas sample and video stream data in live back to the command centre.

And, they are also looking at trying to see how they can use satellite command and control and ensure that these systems are able to give you data in real time. Essentially, there is a gas analyzer which is part of the payload of this drone and it is remotely controlled. So, these are possibilities and if it has to withstand these harsh conditions, it is not a joke you a lot of engineering required. So, this is one demonstration of the application of drone a novel application of the drone. In the example that we have taken our system essentially is a I will come back to some of the other aspects of it, but let us look at what exactly was built in the in in the video that I had shared with you right.

So, there the idea is that the drone has to identify applied flying from point a to point b, it has to land at point b to deliver medicines or pick up blood samples to take it back to hospitals, and do analysis and prepare hospitals for accepting patients, and planning for blood requirements and so on that part. And, in that in this demonstration that I showed you it was about charging the drone, which is also an important problem.

(Refer Slide Time: 04:17)



As, I mentioned to you these are all done by students like my two M. Tech students, Jishnu and Vishnu who worked on it quite extensively, this is something that you may want to think of when you are trying to build drone based first responder systems.

Do you want to land if you want to land what kind of infrastructure is required and what kind of compute power will be required, how are drones going to be useful, what is the payload you want to take and so on and so forth.

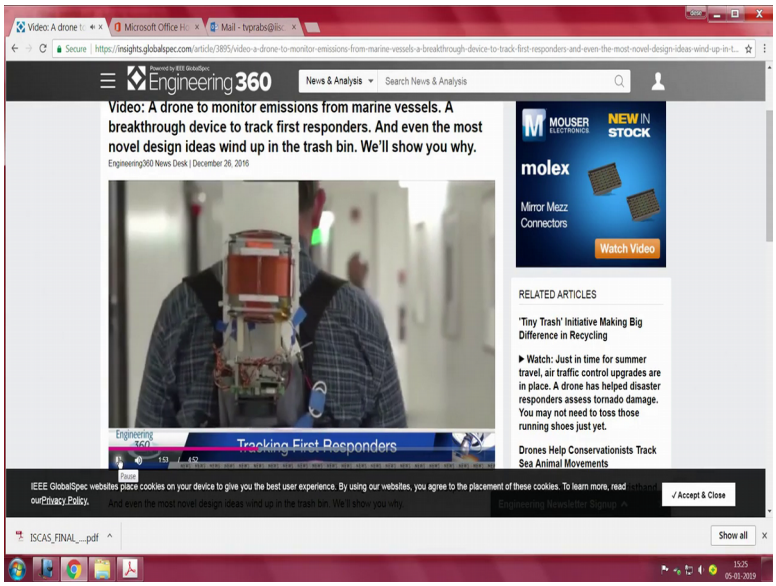
So, let us now again turn back to the problem of indoor fire fighters and first responders who are entering a building and all that ok. I will show you another video and I will capture and I will show you what is actually happening in this area of first responders, currently the kind of thought that is going behind you know any development and where IoT can actually play a very important role.

First, thing is first responders to be localized is an important requirement for the person who is coordinating the rescue operation. So, you must get to that, I want to know where my purse the first responder personnel are and in what pose are they have they fallen down, or they bending down, or are they getting up, or they are moving around. And if so, where are they, this is very very important. I showed you another example in the other paper, where the SDP part was useful in getting pictures from the infrastructure that is there within the building.

You cannot assume that that is available all the time, this is that is one type of problem; this is another type of problem. So, everything boils down to believe me, any module you take localization appears to be the hardest problem, you want to pinpoint it. RF based localization is has not worked it will work, but it is not meant for first responders requirements, it will work to some degree, it has not worked for first responder systems.

Therefore, what people have done is they have gone ahead and they have designed newer systems newer technologies, because radio waves are uncontrollable they go all over the place. But, if you can have a sort of a what is known as a quasi static electromagnetic field, then you essentially can perhaps do a lot of magic there. And, essentially I will show you a video which uses this quasi static electromagnetic field, this is designed by US NASA for first fire the developing a technology for first responders.

(Refer Slide Time: 07:03)



And, let us see how it looks here is the here is a first responder, who bearing the quasi static electromagnetic field system onto his body.

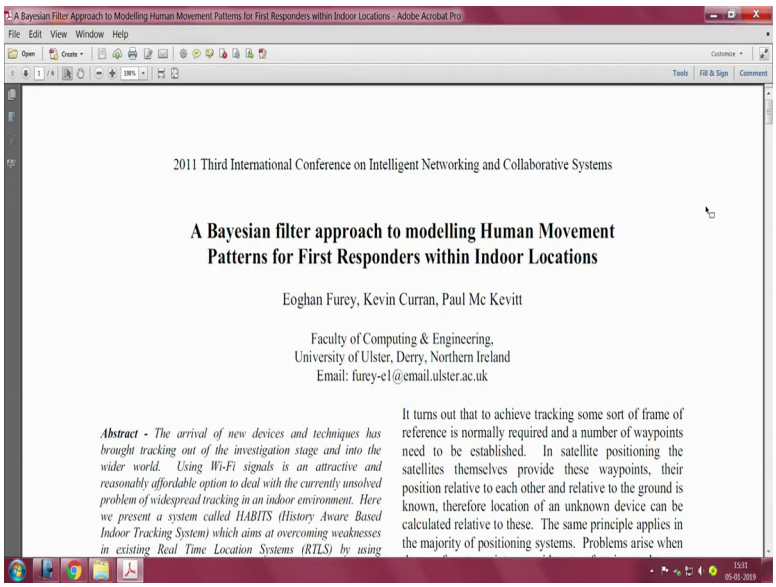
(Refer Slide Time: 07:19)

So, then he goes through it and I enters a building this signal does not go more than 100 yards this is very important. So, you can see and if he bends, it can actually know the pose of the system, and you can actually know that he has bent. And, you can see whether he is standing up or whether you can see now, he is sitting there and clearly it says that the system he is sitting down and he is going close to a particular place.

What he is doing everything can be tracked quite accurately with this quasi static so, he is bending now you can see. And, it can be put as a backpack behind and this is quite a exciting technology, which you may want to actually use and you have to develop basically, you have to develop this technology and start seeing how we can deploy them for several applications.

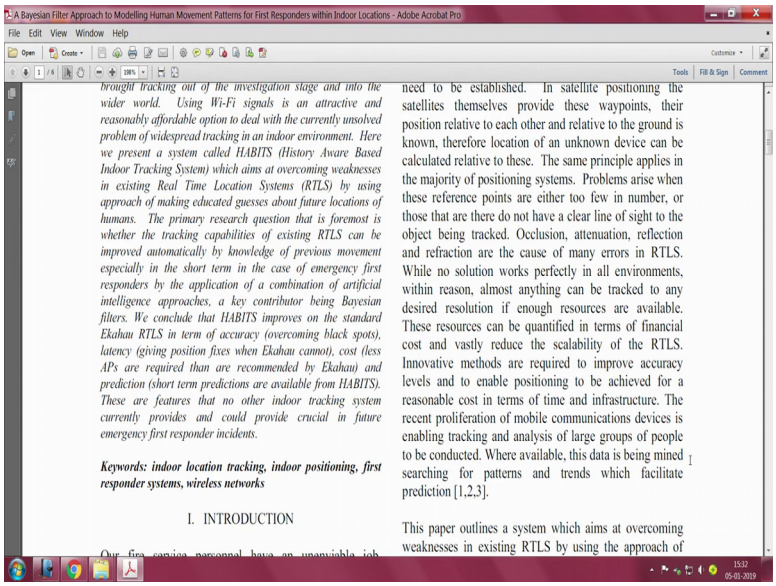
While, you know these quasi static electromagnetic fields appears to be extremely attractive, you have to build that system and make it into a backpack and all that it has not stopped researchers from investigating continue to investigate using WI FI signals and all that. So, that is a bug you want to keep trying to see how what kind of new algorithms can be tried out, and you can apply them to into trying to you know locate first responders accurately inside the building. So, as I said there was a paper again in 2011 quite some time back, which was trying to get to sort of a Bayesian filter approach.

(Refer Slide Time: 08:51)



To modelling human movement patterns for first responder with an indoor locations of course, this work is something that is prior to what I showed you with respect to quasi static electromagnetic fields. So, you have to look at it from more of an out of order kind of a paper, but previous work has really been in this direction.

(Refer Slide Time: 09:19)



Essentially, it uses you they call they come up with a you know sort of a system, which they called habits it is called history aware based indoor tracking system, and which over comes the real time location systems like, you know a Ekahau; Ekahau is essentially another technology system. And, it sort of comes overcomes that we conclude that habits improves on the standard Ekahau RTLS system, that essentially is real time location systems and they improve on it.

The point I am trying to make again here is that while you can read this paper understand and all that, the takeaway from all this is location localization of the first responder has been the effort of many people in the area of you know the has been the main effort in this area of first responder networks. Therefore, I want to conclude and tell you that any system that you want to build in the first responder networks, if you have a good localization algorithm for localizing the first responder who has gone inside to rescue the people inside, I think will really be a good solution.

Therefore, kindly investigate in that direction and these are future directions for several other projects, which you can several other projects that you may want to take up. Final word about this work by is quasi as you know this quasi static electromagnetic fields, the whole work is called a pointer. So, if you Google for pointer you will see the work of JPL of NASA and the whole paper is well documented you can see how they try to do the localization quite accurately including pose estimation and so on.