**Structural Health Monitoring (SHM)**
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**Lecture – 55**
**Part - 1: Wireless Sensor Networking (WSN) – Part 1**

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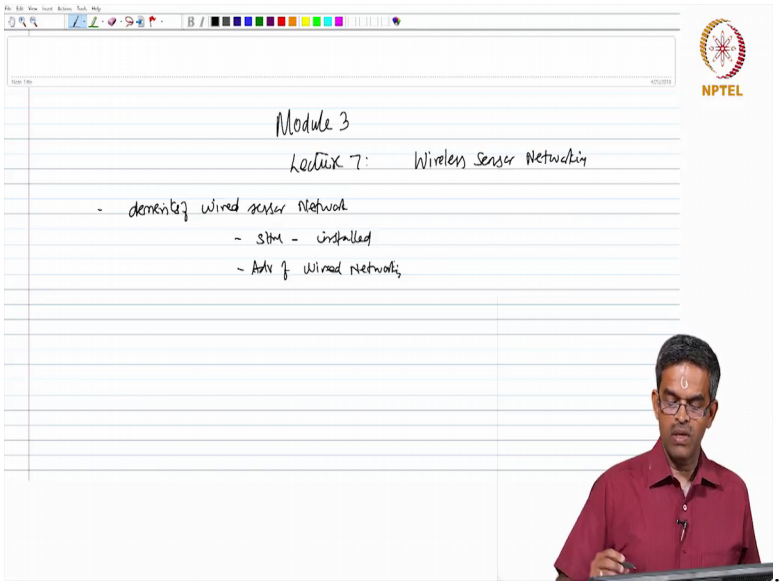


Friends, welcome to the next lecture in module 3, this is lecture 7 where we will discuss more details about Wireless Sensor Networking. In the last lecture we compared and highlighted, the demerits of wired sensor network, even though there are a system processes, which have been successfully installed in many public buildings and structures in different places all over the world.

There are advantages of wired sensors or wired networking, but still let us see what are those factors, which govern, which necessitates the invention of wireless sensor networking.

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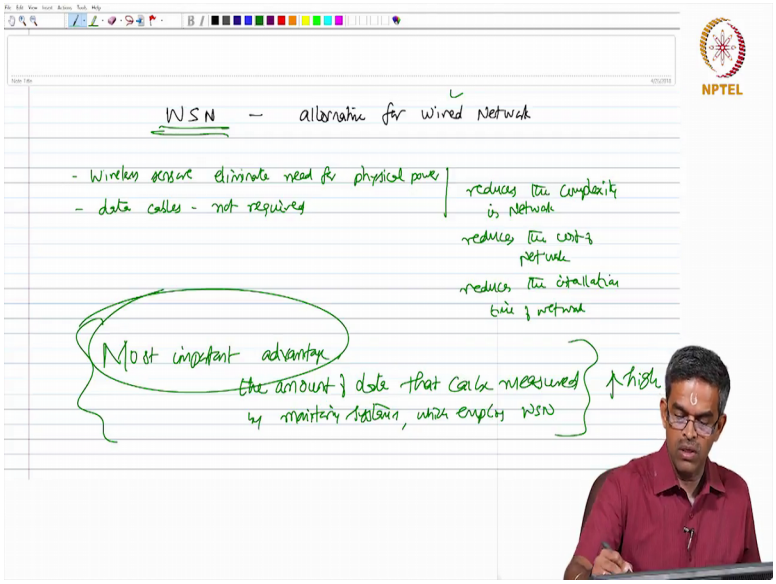


Wireless sensor networking is considered as an alternative for wired network. Please understand there is no supremacy of both of them it is an alternate method of doing networking for structural health monitoring.

Therefore, essentially the method by which you measure the data, you collect the data, you place the sensors, you array the sensors will differ, but the pattern of observation monitoring damage detection will remain more or less the same in both conditions of wired and wireless system adopted for structural health monitoring. So, it is a question of convenience of laying the sensors for acquiring the data, transmitting the data, processing and invoking any control measurements.

If it is necessary only the advancements happen in that stage, but the basic methodologies of using vibration based measurements etcetera remain identical in both the cases. So, the foremost advantage you see here is wireless sensors eliminate the need for physical power. There is no need for data cables and this reduces the complexity in layout, this also reduces the cost of network, it also reduces the installation time of network.

The most important feature the most important advantage what we can put is that the amount of data. That can be measured by the monitoring systems, which employ wireless sensor network. This amount of data is phenomenally high, that is the major advantage we have in wireless sensor networking compared to the wired networks.

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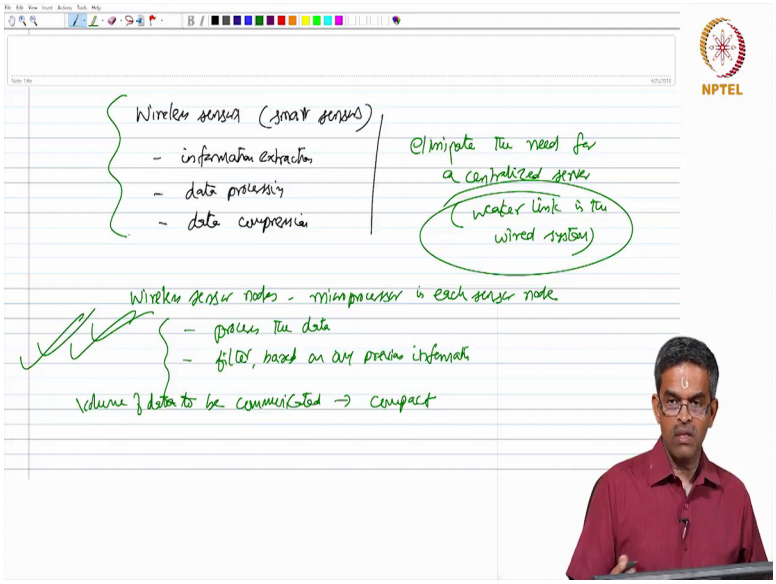


So, wireless sensor networks, which are otherwise smart sensors capacity for information extraction, to do data processing, then they have capacity to do data of compression the need for a centralized server which was a weaker link in the wired system anyway. So, that is eliminated by wireless sensor networking. Wireless sensor nodes also have microprocessor, which we saw in the last lecture in each sensor.

Node which can process the data, filter the data, based on any previous input. So, this reduces the volume of data to be transmitted becomes compact.

So, one can say that is the next advantage, we have it eliminated the weaker link it made the data transformation very compact, it has lot of information which were not otherwise provided by the wired sensors.

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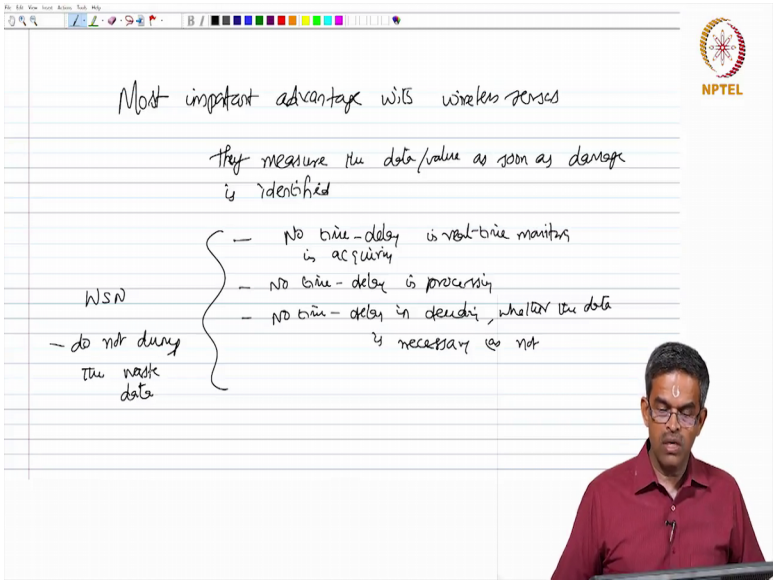


The most important advantage we have now with wireless sensors is that they the data or the value as soon as damage is identified. It means that no time delay in real time monitoring, in acquiring the data, no time delay in processing the data, more time delay in deciding whether the data is necessary or not.

So, wireless sensor networking, do not dump the waste data ok. They only dump or they only communicate the most important sensible data.

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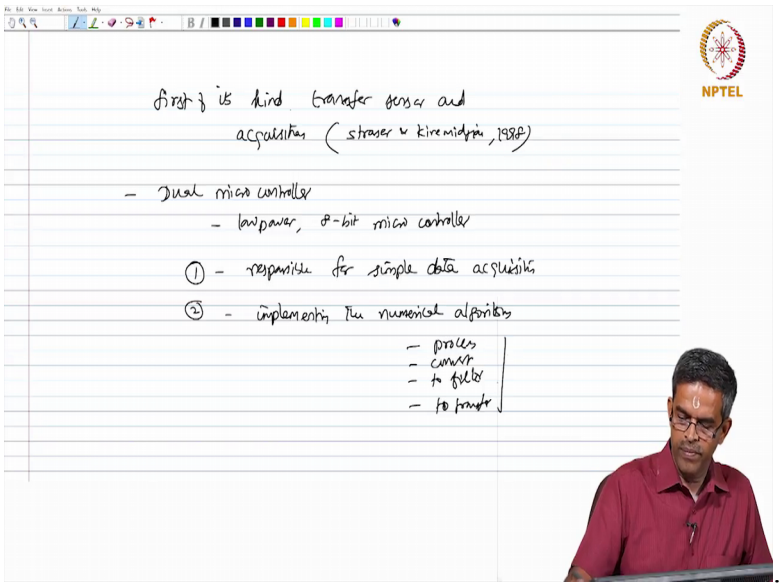

So, the first of it is kind transfer sensors and acquisition in 1998 this has a dual microcontroller. It has a low power 8 bit controller in which one controller is responsible for simple data acquisition.

And the other one is used for implementing the numerical algorithms those are required, to process, to convert, to filter, and then to transfer.

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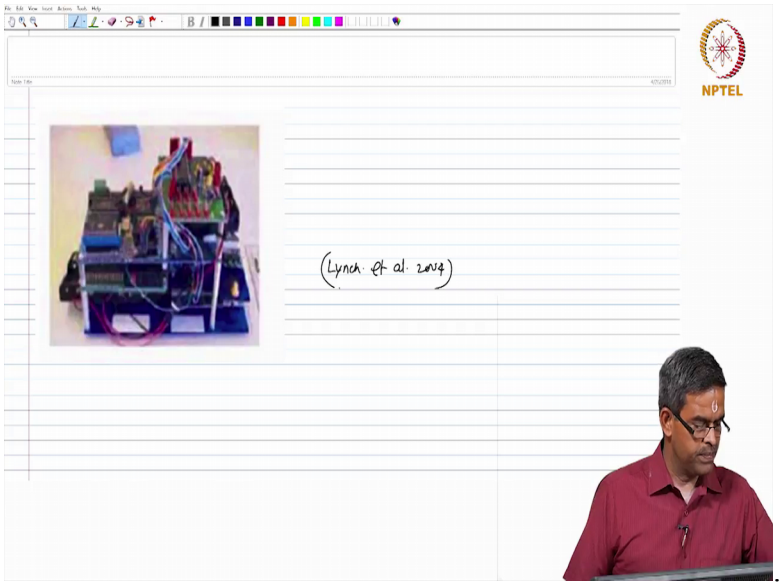


A typical picture of this is what is seen in the screen here this is a dual processor, first time introduced wireless communication receiver, which had acquisition server inbuilt ok.

The reference of this and more details can be seen at lynch et al in 2004 further.

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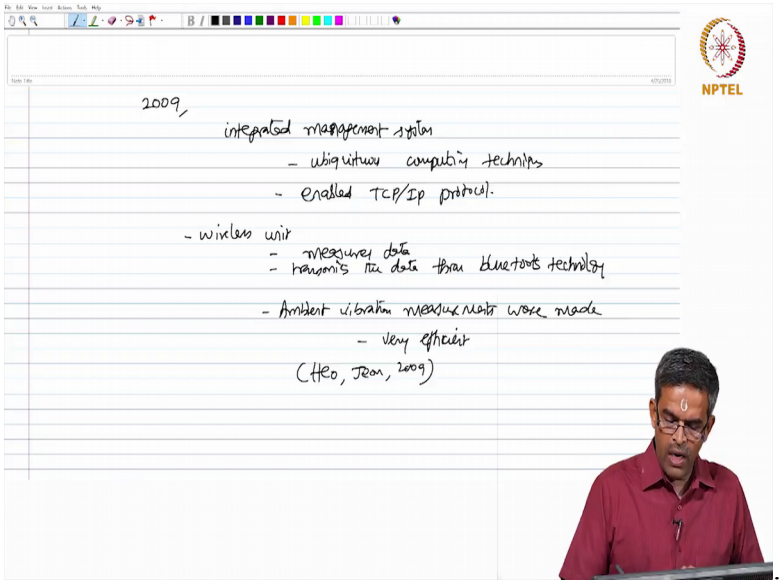


In 2009 sensors with integrated management system was developed this used ubiquitous computing techniques the design enabled both TCP and IP Protocol. The wireless unit which was fabricated measures the data and also transmits the data.

Bluetooth technology ambient measurements were made; ambient vibration measurements were made using the sensor and found to be very efficient. There are advantage of the system, this system the integrated system, acquisition unit that can collect data from various sensor nodes of even different types.

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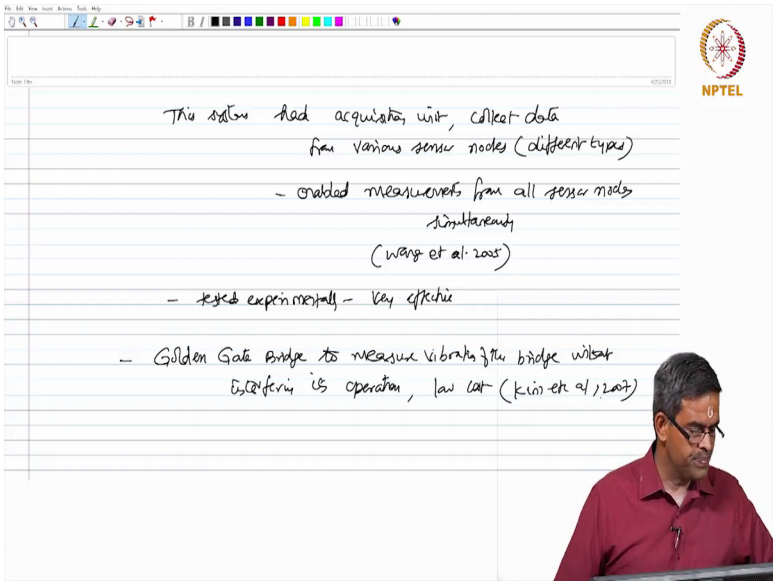

There are different types of sensors we already seen them in the last lecture. It enabled measurements from all sensor nodes simultaneously, that is very important. So, the speed and efficiency was much higher, one can see these details more in Wang et al 2005.

The unit was tested experimentally and found to be very efficient this was used in Golden Gate Bridge to measure the vibration of the bridge, without interfering it is operation that is very important no cable laying nothing was happening. This was also done at a very low cost details can be seen at Kim et al in 2007.