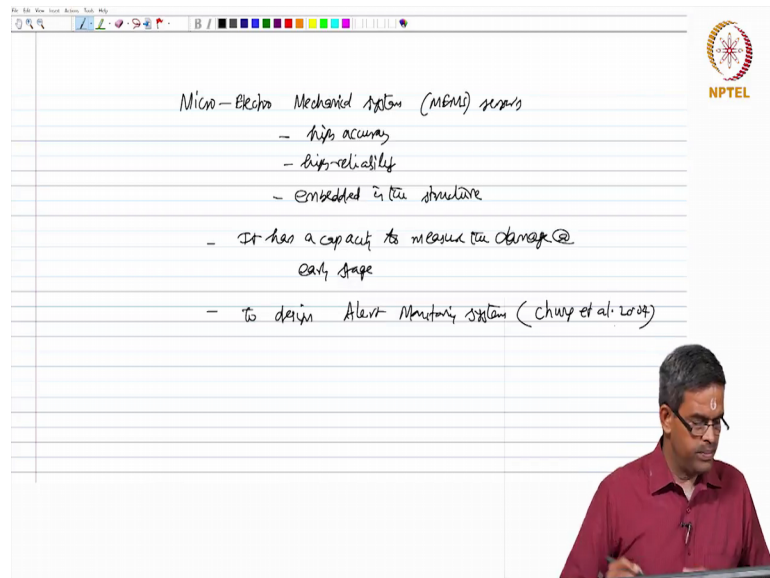


Structural Health Monitoring (SHM)
Prof. Srinivasan Chandrasekaran
Department of Ocean Engineering
Indian Institute of Technology, Madras

Lecture – 56
Part - 2: Wireless Sensor Networking (WSN) – Part 2

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Micro-Electro Mechanical System (MEMS) sensors

- High accuracy
- High reliability
- Embedded in the structure
- It has a capacity to measure the damage @ early stage
- to design Alert Monitoring system (Chung et al. 2009)

So, this used Electro Mechanical system sensors they had high accuracy, high reliability, they can also be embedded in the structure. It has a capacity to measure the damage at early stage, to design an alert monitoring system.

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sensing unit was designed with RISC microcontrollers
and MEMS-based accelerometers

- sensing unit - fast computation for data processing

So, this was first proposed as an idea by Chung et al in 2004 the sensing unit was designed with RISC microcontrollers, MEMS based accelerometers, showed a fast computation capability for data processing, because it has inbuilt microprocessors.

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details of the development can be seen Lynch et al (2001).

The sensor is shown in this figure here details can be seen of the development, can be seen Lynch et al 2001 is related to statistical pattern recognition in brief SPR.

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Issue - Statistical pattern recognition (SPR)

In SHM scheme,

a module was developed

- operational evaluation
- data acquisition
- feature extract
- statistical model

- Coupling of integrated hardware approach was used

- Transmission Board - Motorola new form - wireless access point in the sensing unit.

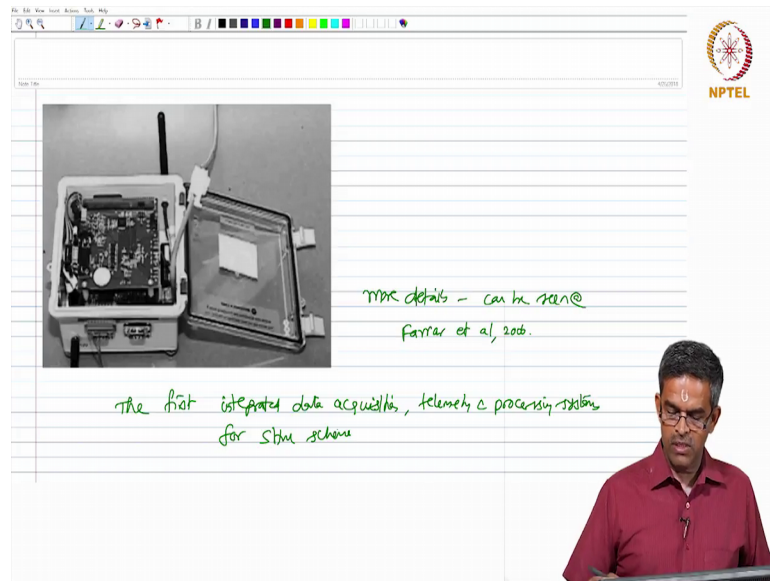
- wire -

So, in SHM scheme a module was developed, which can do operational evaluation, data acquisition, feature extraction, and then a statistical model based on that. And all are required to be now developed that is the next stage of advancement happened in wireless sensor networking.

So, coupling of integrated hardware approach the transmission goal was developed by Motorola new form, which provided the wireless access point in the sensing unit.

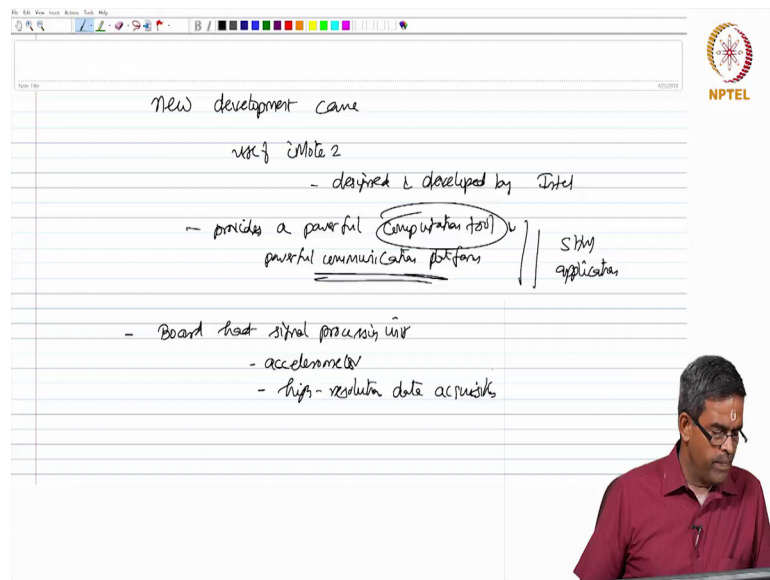
This had a transmission board online the unit is shown in this figure more details can be seen at Farrar et al 2006.

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The first integrated data acquisition system, which has telemetry and processing systems, for structural health monitoring scheme.

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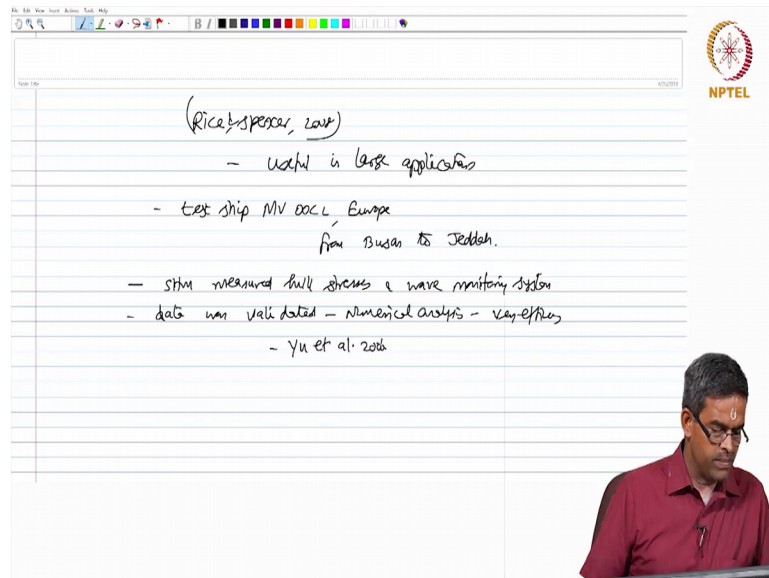
The system showed better capabilities other than the different systems used at that point.

The new development came into play with use of I Mote 2 which is designed and developed by Intel; this provides a powerful computation tool, because we are talking about the statistical pattern recognition. So, computation tool was important and also you have powerful communication platform. So, the advantages where computation tool and

communication platform which were, the highest demand in SHM application in the recent past.

The board had signal processing unit and high resolution data acquisition.

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The image shows a presentation slide with handwritten notes in black ink on a white background. The notes are as follows:

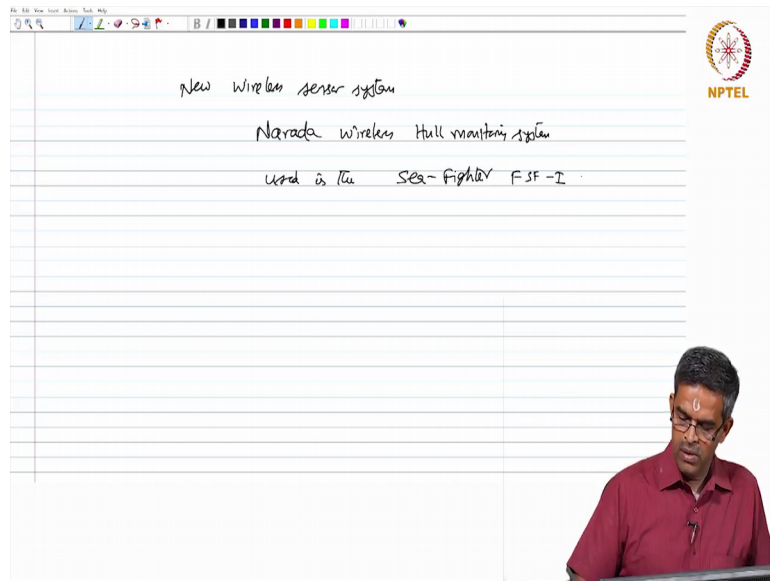
- (Rice & Spencer, 2007)
- useful in large applications
- test ship MV OOCL Europe
from Busan to Jeddah.
- SHM measured hull stresses & wave monitoring system
- data was validated - numerical analysis - very efficient
- Yu et al. 2006

In the bottom right corner of the slide, there is a small inset image of a man with glasses and a red shirt, looking down. The NPTEL logo is visible in the top right corner of the slide area.

And they said these sensors are very useful in large applications test ship that is MV OOCL Europe, which travels from Busan should to Jeddah this was first commissioned in that.

The structural health monitoring measured the hull stresses and it also had the wave monitoring system. The data was validated with detailed experimental numerical analysis and found to be very efficient.

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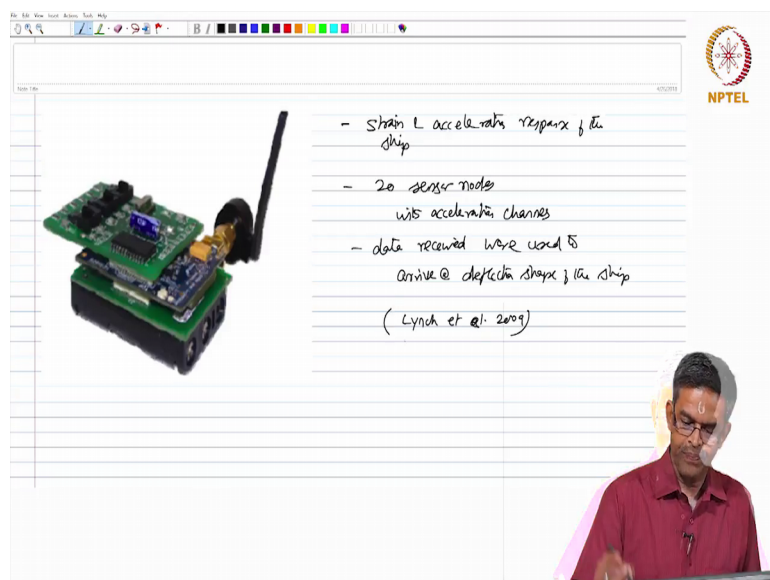


New wireless sensor system
Narada wireless Hull monitoring system
used in the Sea-Fighter FSF-1

So, these comparisons were reported by Yu et al in 2006. A new wireless sensor system Narada wireless hull monitoring system, which was used in the sea fighter FSF 1.

So, the picture shows it measured the strain and acceleration response of the vessel of the sea fighter.

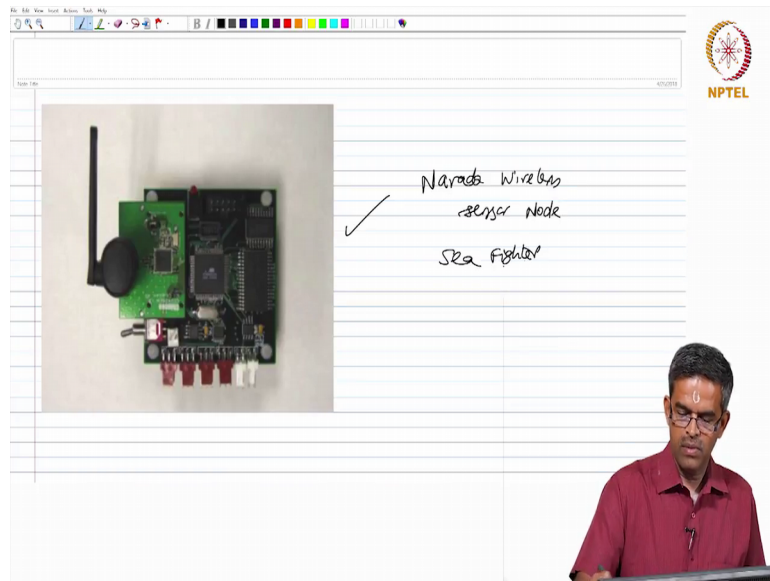
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- strain & acceleration response of the ship
- 20 sensor nodes with acceleration channels
- data received were used to arrive at deflection shape of the ship
(Lynch et al. 2009)

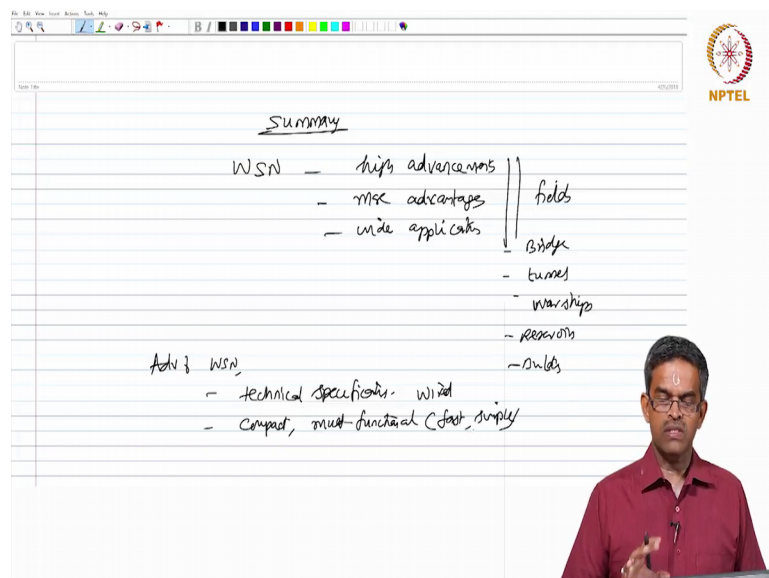
This unit have 20 sensor nodes the data received from this where used deflection shape of the vessel Lynch et al 2009. So, that is the data what we have.

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This is the Narada wireless.

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Wireless sensor networking has seen high advancements, more advantageous, wide applications, at different fields like for example. Construction engineering bridges, tunnels, naval architecture ships, essentially warships, reservoirs, buildings, etcetera. So, we have seen the major advantages of wireless sensor networking.

We have seen the technical specifications of the wireless sensors compared to the wired sensors. We have also seen how they are compact? How they are multifunctional? And therefore, how they are fast and simple?

In the future lectures we will discuss about more on the layout of the design of wireless sensor networking on a lab scale, which has been done. To really analyze 2 parallel networking systems to compare the advantage of each one of them, in terms of system configuration, acquisition of the data, transmission capabilities, and data management etcetera.

Thank you very much and bye.