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Module 3

Lecture 7: Wireless Sensor Networking

- Overview of wired sensor Network
  - STM - installed
  - Adv of Wired Networks

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WSN — alternative for wired Network

- Wireless sensors eliminate need for physical power
- data cables - not required

reduces the complexity of Network
reduces the cost of network
reduces the installation time of network

Most important advantage
the amount of data that can be measured by monitoring systems, which employ WSN ↑ high

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Wireless sensors (smart sensors)
- information extraction
- data processing
- data compression

Eliminate the need for a centralized server

(water link is the wired system)

Wireless sensor nodes - microprocessor in each sensor node
- process the data
- filter, based on any previous information

Volume of data to be communicated → compact

Most important advantage with wireless sensors

They measure the data/value as soon as damage is identified

- No time-delay is real-time monitoring is acquiring
- No time-delay is processing
- No time-delay in decision, whether the data is necessary or not

WSN

- do not dump the waste data

first of its kind. transfer sensor and acquisition (Fraser & Kiremidjian, 1988)

- Dual micro controller
  - lowpower, 8-bit micro controller
  - (1) - responsible for simple data acquisition
  - (2) - implementing the numerical algorithms
    - process
    - convert
    - to filter
    - to transfer

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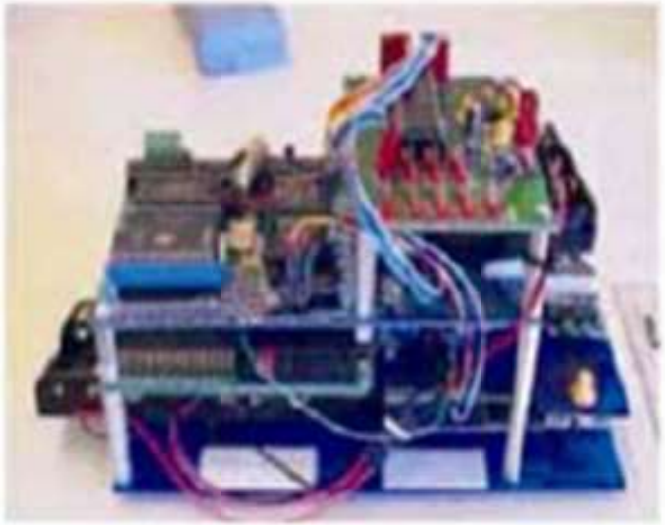

(Lynch. et al. 2014)

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2009,

integrated management system

- ubiquitous computing technique
- enabled TCP/IP protocol.

- wireless unit
  - measure data
  - transmits the data through bluetooth technology

- Ambient vibration measurements were made
  - very efficient

(Heo, Jeon, 2009)

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This system had acquisition unit, collect data from various sensor nodes (different types)

- enabled measurements from all sensor nodes simultaneously (Wang et al. 2005)

- tested experimentally - very effective

- Golden Gate Bridge to measure vibrations of the bridge without interfering its operation, low cost (Kim et al, 2007)

Micro – Electro Mechanical systems (MEMS) sensors

- high accuracy
- high reliability
- embedded in the structure

- It has a capacity to measure the damage @ early stage
- to design Alert Monitoring systems (Chung et al. 2004)

sensing unit was designed with RISC micro controller
and MEMS-based accelerometer

- sensing unit - fast computation for data processing

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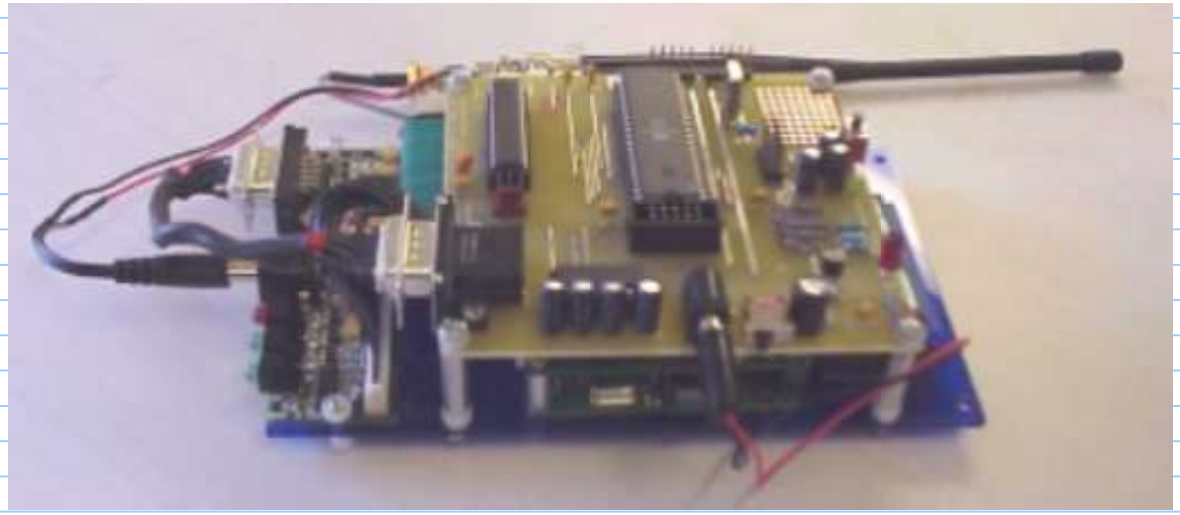

details of the development can be seen @ Lynch et al, (2001).

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Issue - Statistical pattern Recognition (SPR)

In SHM scheme,

a module was developed

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

- Coupling of integrated hardware approach was used
- Transmission Board - Motorola new RFon - wireless access point in the sensing unit.
- online -

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more details - can be seen @
Farrar et al, 2006.

The first integrated data acquisition, telemetry & processing system for SHM scheme

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new development came

use of iMote 2

- designed & developed by Intel

- provides a powerful computation tool & powerful communication platform || SHM applications

- Board had signal processing unit
  - accelerometer
    - high-resolution data acquisition

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(Rice & Spencer, 2008)

- useful in large applications

- test ship MV OOCL Europe
  from Busan to Jeddah.

- SHM measured hull stress & wave monitoring system
- data was validated - Numerical analysis - very effective
  - Yu et al. 2006

New wireless sensor system

Narada wireless Hull monitoring system

used in the Sea-Fighter FSF-I

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- Strain & acceleration response of the ship
- 20 sensor nodes
  with acceleration channels
- data received were used to
  arrive @ deflection shape of the ship

(Lynch et al. 2009)

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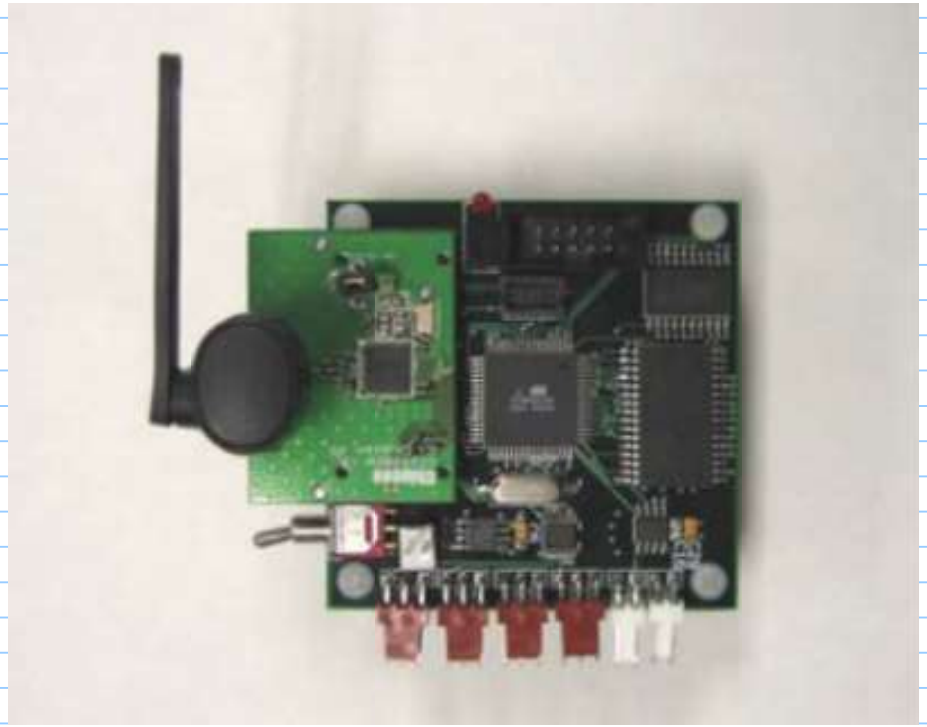

Narada Wireless
sensor Node

Sea Fighter

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Summary

WSN — high advancements
— more advantages
— wide applications ↓ fields

- Bridge
- tunnel
- warships
- Reservoirs
- Buildings

Adv of WSN

- technical specifications. wired
- Compact, multi-functional (fast, simple)