SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)
COIMBATORE-35

III YEAR CIVIL ENGINEERING

19CEO304-BUILDING MAINTENANCE

STRUCTURAL HEALTH MONITORING

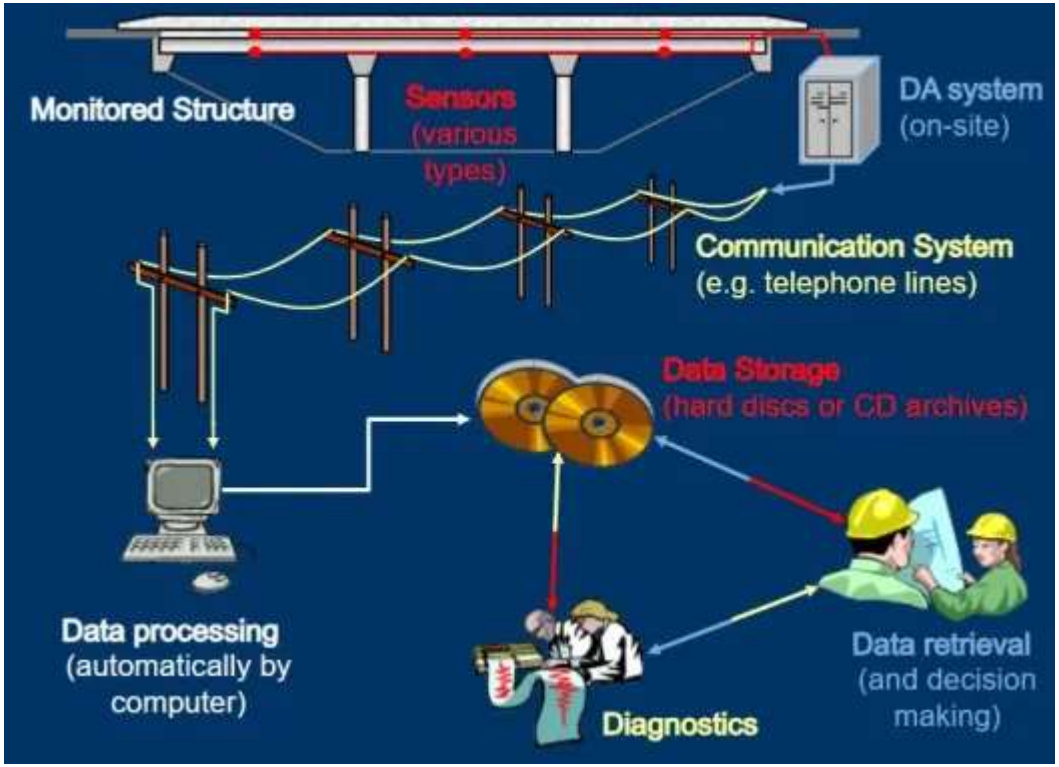
Structural health monitoring (SHM) is the process of using damage detection and characterization techniques for critical structures like bridges, wind turbines, and tunnels. It is a non-destructive in-situ structural evaluation method that employs several types of sensors embedded or attached to the structure.

The structural health monitoring process includes installing sensors, data acquisition, data transfer, and diagnostics through which the structure's safety, strength, integrity, and performance are monitored. If overloading or any other defects are observed, proper correction measures are suggested.

PURPOSE OF STRUCTURAL HEALTH MONITORING

- Improve performance (safety and functionality) of existing structures.
- The placement of sensors during construction works enables observers to assess the structure's condition and specify its remaining life span.
- Evaluate the integrity of a structure after earthquakes.
- Structural monitoring and assessment are essential for on-time and cost-effective maintenance. So, it reduces construction work and increases maintenance activities.
- The SHM process collects data on the realistic performance of structures. This data can help design better structures in the future.
- Shift towards a performance-based design philosophy.

Components of Structural Health Monitoring System



COMPONENTS OF STRUCTURAL HEALTH MONITORING SYSTEM

Structure

The critical structures like bridges, tunnels, dams, and wind turbines are mostly monitored as they are a vital part of the national infrastructure.

Data Acquisition System

Data acquisition addresses the number and type of sensors, how to activate sensors, and techniques to save data. The placement of sensors should not alter the behavior of the structure. This can be achieved by considering the placement of wiring, boxing, etc., at the design stage.

Sensors need to be appropriate and robust and serve their function adequately for a specified duration. Each sensor may evaluate a particular aspect of the structure. They measure strain, deflection, rotation, temperature, corrosion, prestressing, etc.

Data Transfer

The transfer of data can be done through a wire which is common and cost-effective but may not be practical for large structures. Alternatively, wireless communication can be considered, which is suitable for large structures, but it is slower and more expensive than the wired method. Telephone lines are another option to transfer data from site to the offsite offices. These data transfer techniques eliminate the need to visit the field for collecting and transferring data.

Digital Processing

After the data is transferred, digital processing is carried out to eliminate unwanted effects such as noises. It should be carried out before the information is stored. Digital processing will make the interpretation of data easier, faster, and more accurate.

Storage of Data

The processed data can be stored for a long time and retrieved in the future for analysis and interpretation.

Data Diagnostics

Diagnostic processes involve the conversion of abstract data to useful information about the structure's condition and its responses to loads. So, the final data obtained from structural health monitoring should be detailed and physical, based on which rational and knowledge-based engineering decisions can be made.

The methodology used for the diagnostics process is dependent on the structure type, location and types of sensors, monitoring purpose, and structural response under consideration.

Structural Health Monitoring Testing Categories

Testing categories of the structural health monitoring system can be classified as follows:

Based on a timescale of monitoring:

- Continuous testing
- Periodic testing

Based on the manner the response is invoked in the structure:

- Static load
- Dynamic load
- Ambient vibrations

Advantages of Structural Health Monitoring

- Improved understanding of field structural behavior.
- Detect damages at an early age of problem initiation.
- Reduced inspection and repair time.
- Encourage the use of innovative materials.
- Help to develop rational management and maintenance strategies.

Disadvantages

- High installation costs.
- Vulnerable to ambient noise corruption.
- Vulnerable to earthquake conditions.
- Challenges with the application of SHM like building accessibility, manipulating the huge amount of data generated by sensors, environmental conditions, etc.
- The size and complexity of large structures need a great number of sensing points to be installed.

THANK YOU…