

Module 3

Lecture 1: Sensor Technologies - I

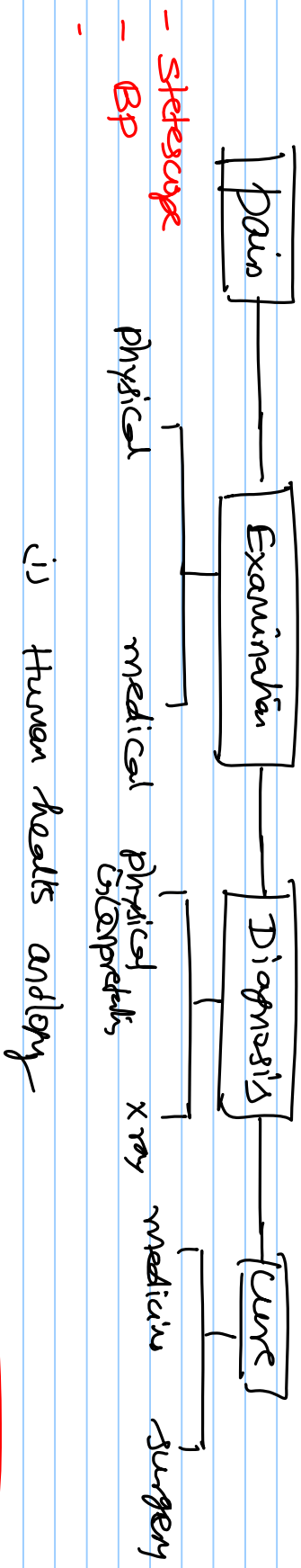
- Most frequently measured parameters (monitored parameters) is strain?

- 3 groups

~~✓~~ Mechanical: Strain, displacement, deformation, crack opening, stress, load

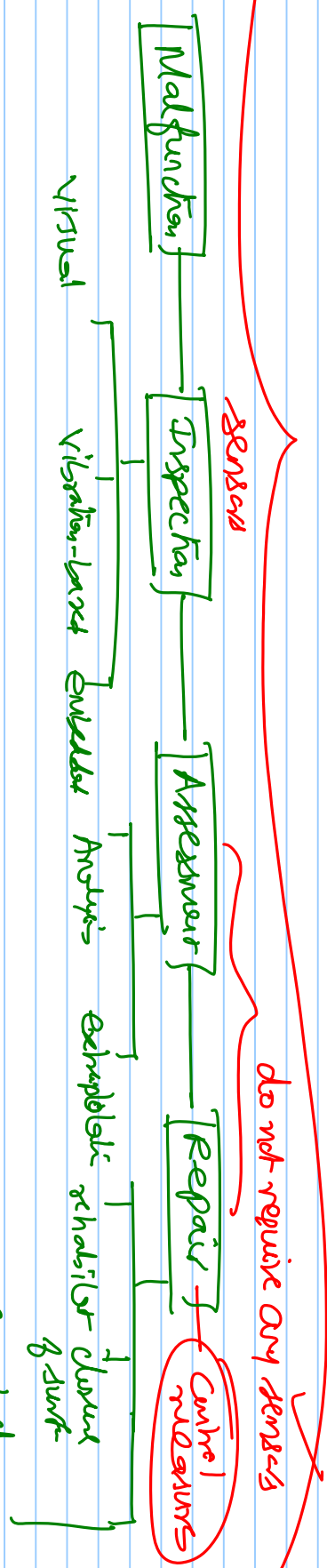
~~✓~~ Physical: Temperature, relative humidity, pore pressure

~~✓~~ Chemical: Chloride penetration, sulphate penetration, pH, carbonates penetration, rebar oxidation, timber decay



is human health and long

detection mechanism



(ii) Structural Health Analysis

- Monitoring can be @ different levels
- sensors should be installed/laid to appropriately measure the desired parameters @ various levels to monitoring

(1) Very early stage of
monitoring ✓

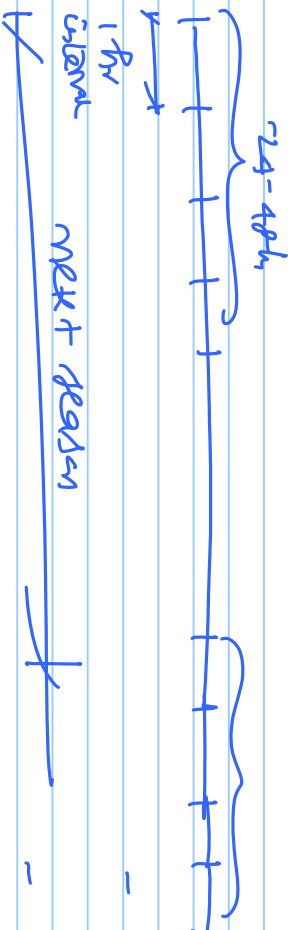
- low-stiffness, embedded sensors are used
 - This is practiced in concrete structures to study the shrinkage effects @ early stage of construction
 - useful to measure strain, that occurs due to extreme weather changes
- {
- period of measurement can vary every hour for the first 24-36 hrs.
 - ④ measurements/sens/day
 - ① measurement/sens/week etc

(2) Continuous monitoring (24-48 hr period)

- Variations in the structural behavior due to temperature effects and load effects are monitored

continuously

- period of measurement ① hr during 24-48 hrs.



- atleast once per year for every year

- record point will be 24-48 hr

1 hr/week - continues

(3) During Construction Stage

- ~~Other~~ structure
- structure, which expects to face foundation settlement effects
- near-fault lines & seismic signals
- Based on the scheduled construction period & monitoring can be fixed
- At least ① measurement/ sensor/ each construction stage is necessary

(4) Testing stage : certain structures are subjected to test loads before they are actually put to functional use

- Railway bridges
- Highway bridges
- reservoir structures
- Coastal jetties
- Dock yards

- period of measurement - ① recording sensor/data of test, where load change is significant

(5) period before reconstruction

- Monitoring is done several times a day at irregular intervals
- In addition, they can be a period monitoring which is continuous month 24-48 hrs to determine effect of temp & load variation on the existing structures
- Based on the observations monitored, reconstruction is demanded.

(6) During reconstruction

- period of monitoring can be ④ times/day/sector for 24-48 hrs
- There can be many such session of recording during every stage of reconstruction

(7) Long-term monitoring

during the service of the structure

- period of monitoring can be at least 1 to 4 measurement/day/sector
- one measurement/sector/week to one/sector/month
- yearly once, a continuous monitoring of 24-48 hrs, every hr/sector

(8) Special event

Measurements on structures are also taken during the event (if possible) and after the event (frequency) to understand the post-event damages and new damages incurred because of aftershock.

- Heavy rains — foundation settlement, exterior corrosion
- Strong wind — foundation uplift, exterior bending, bending cracks
- Earthquake —

Data Management

- managing the observed data
 - very crucial
 - These data can be collected
 - manually
 - semi-automatic
 - complete automatic
 - They can also be collected
 - on site (as by remote applications)
 - periodically (as continuously)
 - static vs dynamic modes
- These options can also be combined

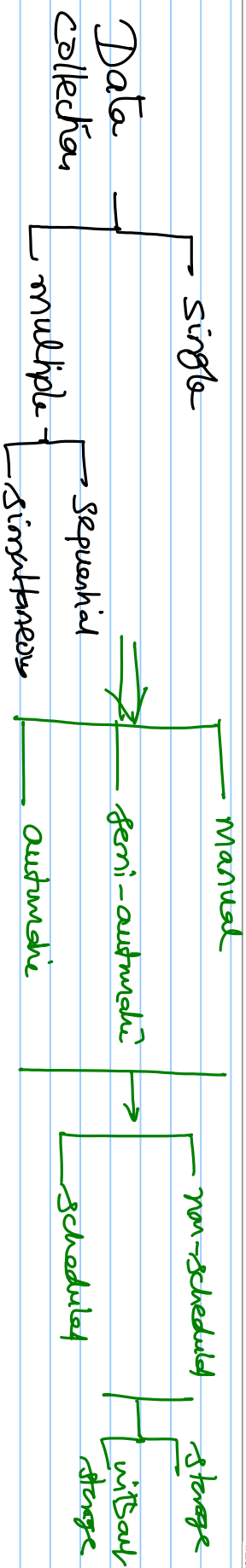
for example,

It can be a coastal jetty

long-term monitoring, maximum performance observed

— which can be either automatic
or remote communication

— If the data is continuously monitored, then it's preferred
to handle the data without human intervention



Data collection and Management

Summary

- sensor technologies
 - different stages of health monitoring
 - STM analysis with human health
 - gender requirements in STM
- (8) stages STM
- Data Collection & Management can be varied in STM protocols.

