AN OVERVIEW ON CONTINUOUS EFFLUENT QUALITY MONITORING SYSTEM

WORKSHOP ORGANIZED BY MPCB, BHOPAL
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Real Time Monitoring System – Why

- Self Monitoring mechanism within the industries
- Increased management responsibility for regulatory compliance
- Increased cost-effectiveness
- Fast corrective action
- Improved control over impacts on the environment
- Higher environmental awareness
- Increased public access to information

Goals of Online environmental monitoring system

- Improved control over impacts on the environment
- Higher environmental awareness
- Increased management responsibility for regulatory compliance
- Self Monitoring mechanism within the industries
- Increased cost-effectiveness (minimize inspection)
- Increased public access to information(Public Domain)

Real-time Water Quality Monitoring

Fresh Water and Wastewater

Options In-situ and Extractive

Advantages and Disadvantages of Flow Through Extractive System

Advantages	Disadvantages
Unit can be coupled with chlorinators to reduce membrane fouling.	120-volt AC power source is needed.
Expensive sensor systems can be secured in vandal-proof shelters.	Higher installation costs are incurred.
Calibration can be performed in the shelter.	Pumps tend to clog in streams with algal fouling or high sediment loads.
	Electrical shock protection is required.
	Pumps may be damaged by corrosive waters.
	Pump maintenance is required.
	Pumping may cause changes in water quality.

Advantages and Disadvantages of In-situ Monitoring System

Advantages	Disadvantages
No power is needed to pump water.	Sensors are susceptible to vandalism.
Remote locations are possible.	The water flow cannot be treated to reduce fouling.
Smaller shelters can be used.	In shallow bank installations, the proper location of sensors in the cross section is difficult.
Pumping maintenance is not required.	Servicing sensors during flooding can be difficult.
Freeze protection is provided to the sensors.	Sensors are susceptible to debris or high flow.
Electrical hazards are reduced.	Shifting channels may cause movement of the equipment.

Monitoring Systems operated by Industries

Air Pollution Monitoring System

- Emission Monitoring Systems
- Ambient Air Quality Monitoring Systems

Ambient Air Quality Monitoring Station

Water Pollution Monitoring System

- Effluent Monitoring Systems

Automatic Water Quality Monitoring of River Ganga

Monitoring Station

Online Effluent Monitoring

Instrumentation of RTEQMS

- Various equipment manufacturers in India and Abroad are capable to supply, install, commission and operate the RTEQMS.
- Technology providers have analyser as well as sensor based equipment's to cater to the needs of RTEQMS.
- General guidelines shall not specify the equipments and technology to be used for setting up of RTEQMS
- Market based system shall be governed for setting up of RTEQMS
- Industrial units/associations shall use the equipment and service providers based on the economics and ruggedness for RTEQMS to last longer (say at least 5 to 8 years)

Parameters	Technologies
pH	Electrode /Electrochemical method
TSS	Scattered Light Method (IR) Nephelometry Method
COD, BOD, TSS	• UV Spectrophotometry (Single/two/four wavelengths) • UV-Visible Spectrophotometry • (Single Beam) • UV-Vis Spectrophotometry (Double Beam)
TOC (Co-relation with BOD & COD)	• Combines Combustion CatalytiC Oxidation at 680°C and NDIR Method • UV Persulfate NDIR Detector • Persulfate Oxidation at 116-130 Deg C NDIR Detector
COD	Measuring COD using ($K_2Cr_2O_7$) + Calorimetric
NH3	• Colorimetric (645-655nm) • Ion Selective Electrode method With temp correction • UV Absorbance or Multiple Wavelength UV Absorbance Spectrophotometers (200-450nm

Parameters	Technologies
COD	**Measuring COD using ($K_2Cr_2O_7$) + Calorimetric**
NH3	• Colorimetric (645-655nm) • Ion Selective Electrode method With temp correction • UV Absorbance or Multiple Wavelength UV Absorbance Spectrophotometers (200-450nm
Chromium	Colorimetric method Reaction of Cr-VI with di-phenyl carbazide in acid solution Voltammetry (Anodic Stripping Voltammetry)
Chromium Hexavalent and Trivalent	Dual Beam UV-Visible Spectrophotometry
Arsenic	Voltammetry (Anodic Stripping Voltammetry)
Besides the above there are Systems/Technologies	many other Monitoring available

Available Technologies	Parameters Measured	Applications
UV Spectrophotometry (Single/two/four wavelengths)	COD, BOD	Fresh Water & Waste Water analysis with constant matrix in water source
UV-Vis Spectrophotometry 40 wavelength	COD, BOD, TSS	Fresh Water & Waste Water analysis with Constant matrix in water source
UV-Visible Spectrophotometry (Single Beam)	COD, BOD, TSS	Fresh Water & Waste Water analysis without interference check and compensation
UV-Vis Spectrophotometry (Double beam with entire spectrum scanning)	COD, BOD, TSS	Fresh water to Waste water analysis Interference check for color and turbidity and compensation.
Combines Combustion Catalytic Oxidation at 680°C and NDIR Method	TOC (Co-relation with BOD & COD)	Fresh Water and Waste Water analysis
UV Persulfate NDIR Detector	TOC (Co-relation with BOD & COD)	Fresh Water & Waste Water analysis
Persulfate Oxidation at 116-130degC NDIR Detector	TOC (Co-relation with BOD & COD)	Fresh Water & Waste Water analysis

Available Technologies	Parameters Measured	Applications
Measuring COD using Potassium dichromate($K_2Cr_2O_7$) + Calorimetric	COD	Fresh Water & Waste Water analysis
Electrode /Electrochemical method	pH	Fresh water & Waste Water analysis
Scattered Light Method (IR)	TSS	Fresh water & Waste Water analysis
Nephelometry Method	TSS	Fresh Water & Less turbid water analysis
Colorimetric (645-655nm)	NH3	Process stream & Waste Water analysis. Turbidity interference is there which can be overcome
Ion Selective Electrode method With temp correction	NH3	Process stream & Waste Water analysis. Turbidity interference is there which can be overcome.
UV Absorbance or Multiple Wavelength UV Absorbance Spectrophotometers (200-450nm)	NH3	Process stream & Waste Water analysis. Turbidity interference is there which can be overcome.
Colorimetric method Reaction of Cr-VI with diphenyl carbazide in acid solution	Chromium	Fresh Water & Waste Water analysis.

Available Technologies	Parameters Measured	Applications
Voltammetry (Anodic Stripping Voltammetry)	Chromium	Fresh Water analysis.
Dual Beam UV-Visible Spectrophotometry	Chromium Hexavalent and Trivalent	Fresh water & waste water analysis.
Voltammetry (Anodic Stripping Voltammetry)	Arsenic	Fresh Water analysis.

Site Selection

- **Fixing of site for installation of RTEQMS should be representative and in compliance to provisions of Consent Management (notified effluent outfall with coordinates-Global Positioning System) to assess temporal changes in the quality of effluent discharged from the premises of industrial unit.**
- **Monitoring site should be accurately displayed with written station location.**
- **Photographic evidence should be obtained in the documentation.**

Data Management and Quality Checks

- **RTEQMS generated data should be validated according to Water Quality Criteria/Effluent Discharge Standards using the methodologies included in the publication of American Public Health Association on Water and Waste Water Examination(20th Edition)**

- **Sensors/analyzers shall have current US EPA reference or equipment method designation and shall be of the latest design.**

Data Management and Quality Checks (contd.)

- Standard Operating procedure should be provided and must contain
  - Operating procedures for all analyzers and sensors
  - Calibration procedures
  - Calibration schedules
  - Maintenance procedures
  - Maintenance schedules
  - Data Transmission procedures
  - Data validation procedures

General Specifications -RTEQMS

- **Equipment's should be capable of operating in a self-powering mode from an internal power supply (using cell batteries/alternative system) with a full payload at a defined sampling interval.**
- **Equipment's should have a non-volatile flash disk memory capable of storing individual readings for a period of at least one year.**
- **Loss of power should not cause loss of memory**

pH (mV)

Parameter	Technical Specification
Measuring Range	0.0 to 14 units of pH
Accuracy	≤ 0.01 units of pH
Response Time	≤ 60 seconds
Operating Temperature	0 to 40^{o} C
Operating Humidity	5 to 95% non-condensing
Power	12 VDC Nominal
Cleaning	Self-Cleaning (Automatic)

COD (mg/l)

Parameter	Technical Specification
Measuring Range	0.0 to 500 mg/L
Accuracy	± 2% + 5 mg/L of certified reference standard
Resolution	≤ 1 mg/L
Response Time	≤ 60 seconds
Operating Temperature	0 to 40^{o} C
Operating Humidity	5 to 95% non-condensing
Power	12 VDC Nominal
Cleaning	Self-Cleaning (Automatic)

BOD (mg/L)

Parameter	Technical Specification
Measuring Range	0.0-50 mg/L
Resolution	≤ 1 mg/L
Response Time	≤ 60 seconds
Operating Temperature	0 to 40^{o} C
Operating Humidity	5 to 95% non-condensing
Power	12 VDC Nominal
Cleaning	Self-Cleaning (Automatic)

Ammonia (mg/l)

Parameter	Technical Specification
Measuring Range	0.0 to 100 mg/L
Accuracy	≤ 3% of full scale
Resolution	≤ 0.1 mg / L
Response Time	≤ 60 seconds
Operating Temperature	0 to 40^{o} C
Operating Humidity	5 to 95% non-condensing
Power	12 VDC Nominal
Cleaning	Self-Cleaning (Automatic)

Total Suspended Solids (mg/l)

Parameter	Technical Specification
Measuring Range	0.0 to 200 mg/l
Accuracy	≤ 5 mg/l
Response Time	≤ 60 seconds
Operating Temperature	0 to 40^{o} C
Operating Humidity	5 to 95% non-condensing
Power	12 VDC Nominal
Cleaning	Self-Cleaning (Automatic)

A model online water quality monitoring technologies

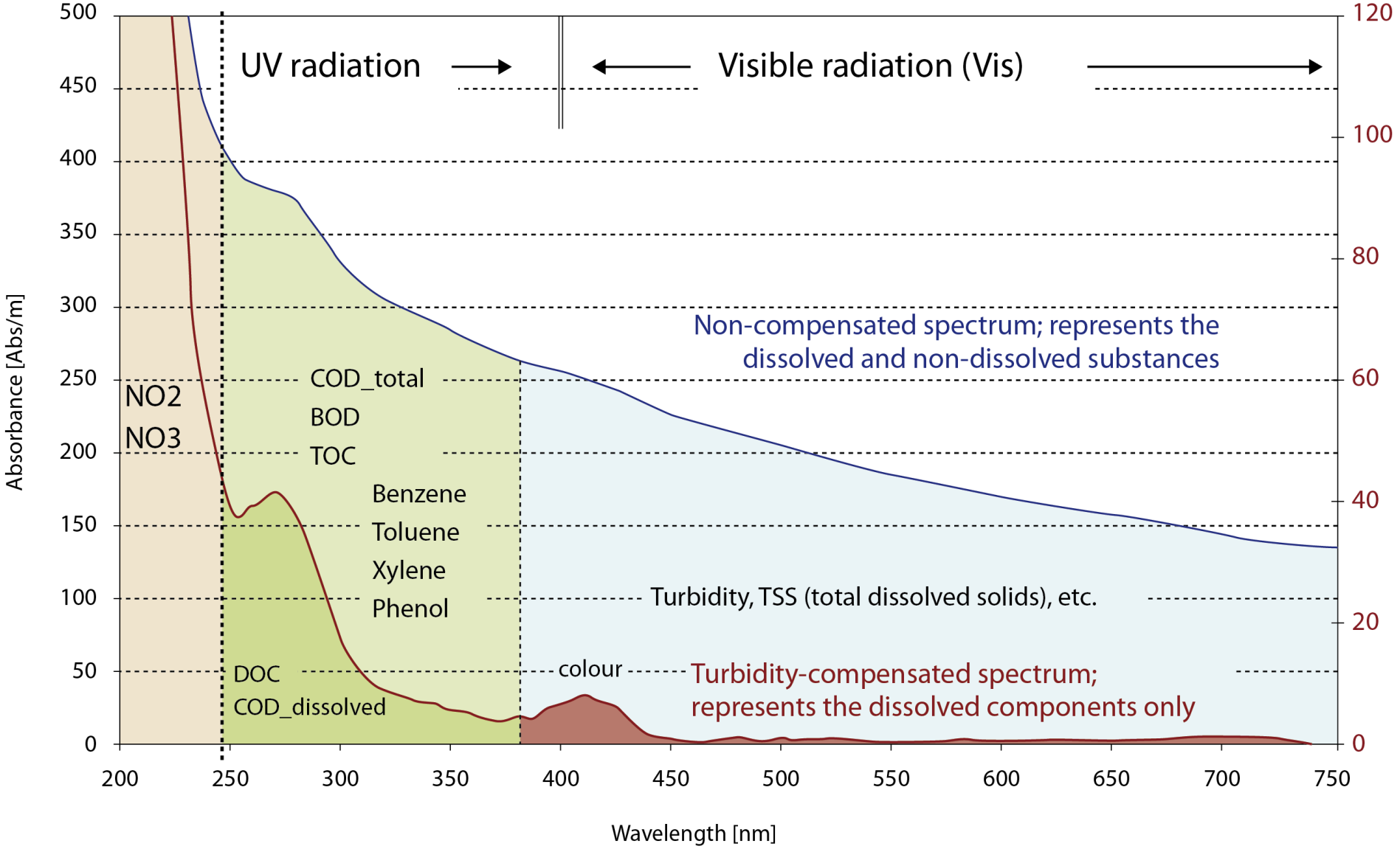
- Replaces old traditional cabinet analyzers and UV probes to have organic analysis without any need of toxic reagents, consumables , spares & regular maintenance.

A model online water quality monitoring technologies

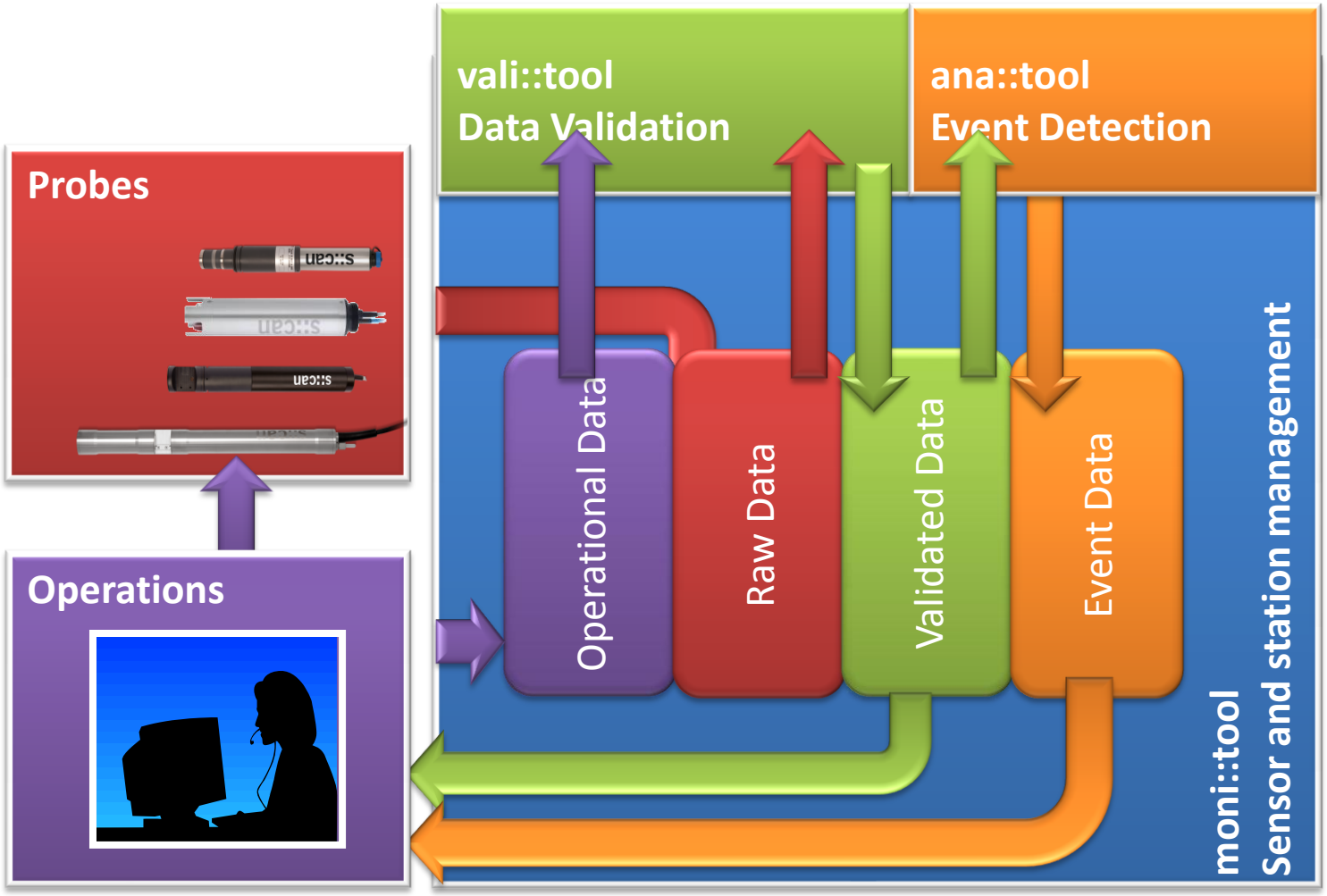
Spectrometer Probes	ISE Probes	Physical Probes	i::scan
			

Online Water Quality Monitoring & UV/Vis Spectrometry

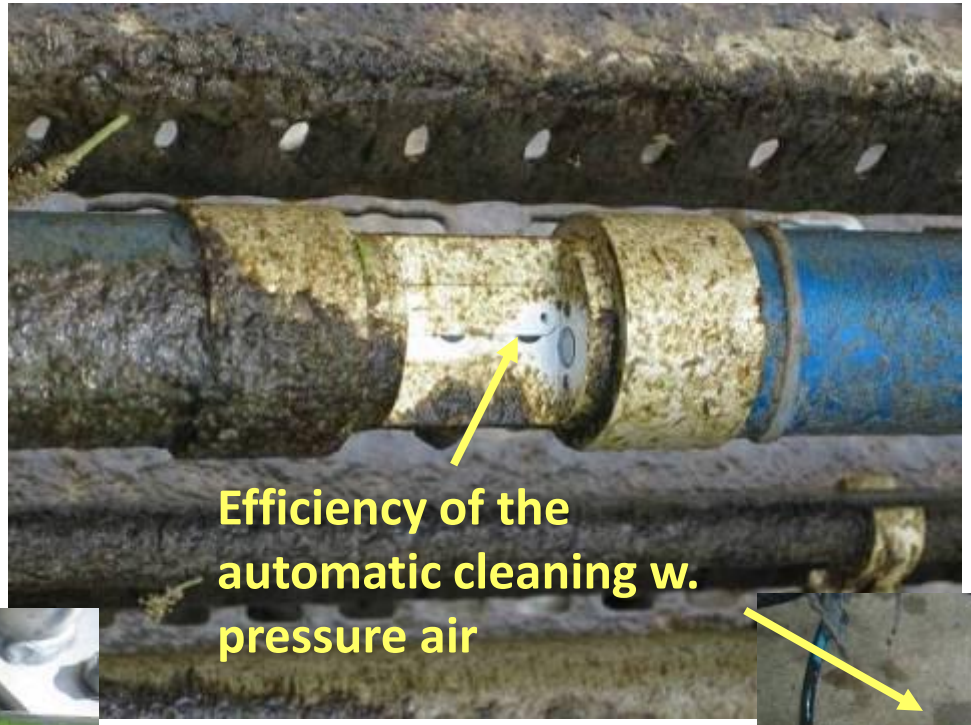
The Measuring Principle – Fingerprint



From Raw Data to Event Detection

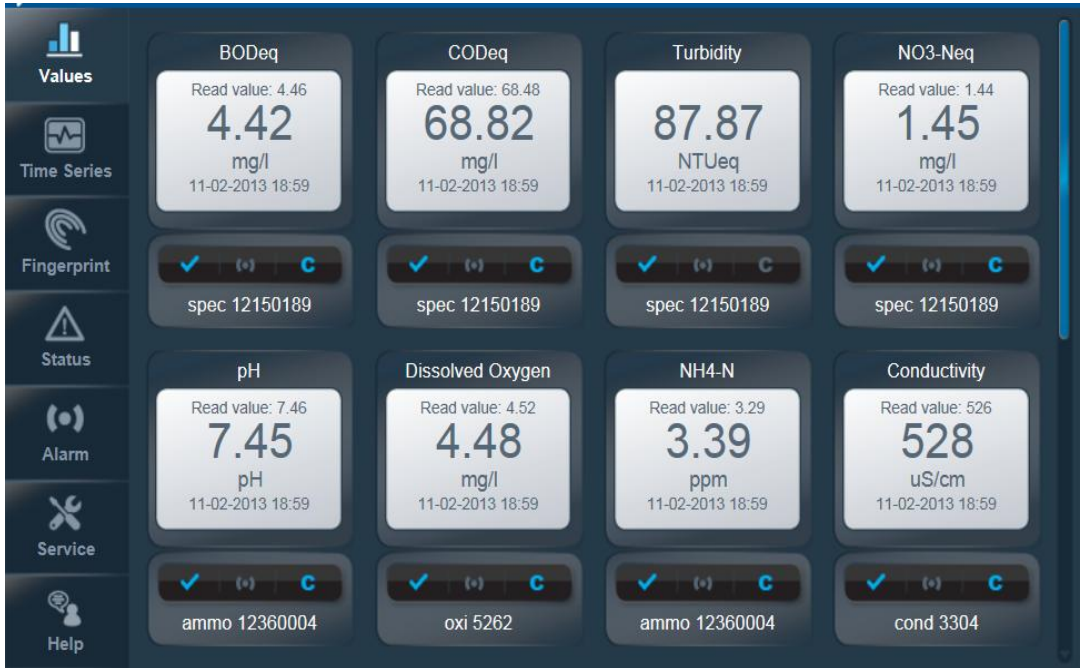


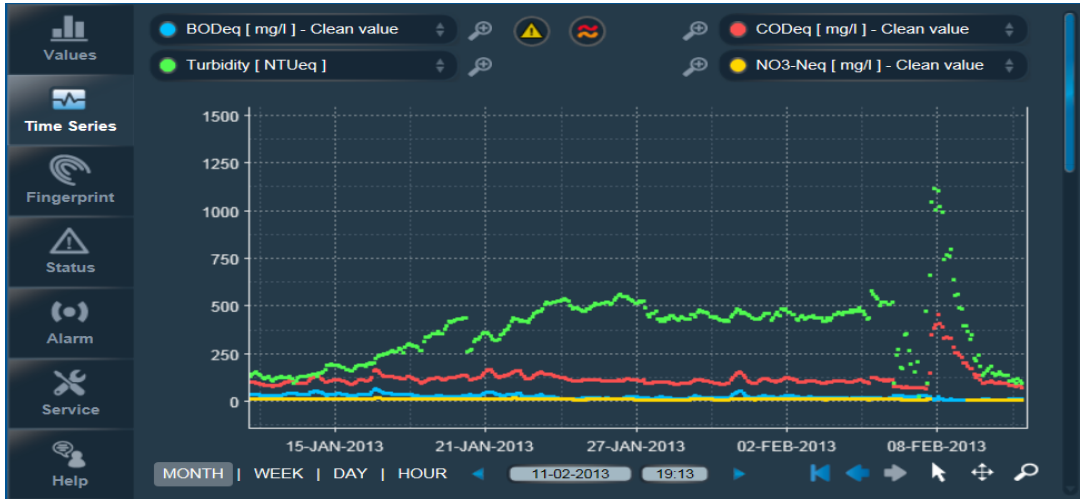
Automatic cleaning of submersed sensors



Real Time Continuous Water Quality Monitoring Stations at the Ganga Basin

- Measurement results from Okhla:
- Continuous results every 10 minutes, automatic file transfer of:
- NTU, COD, BOD, NO3, DO, pH, NH4-N, EC, Cl-, Temp





THANK YOU

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