

***CHAPTER 04 - Smart Water Management with “scada” System***



**4.1 Introduction:**

Dhaka Water Supply and Sewerage Authority (DWASA) is the Government authority for water supply and sewage disposal of the city Dhaka, DWASA operates a big water production and distribution network. The pumping stations equipped with deep tube wells, are the main network nodes of the system. DWASA management wants to implement a SCADA (Supervisory Control and Acquisition) system in the network, complete with remote monitoring and control. For that reason, DWASA management had formed a committee to produce a conceptual overview to WASA for a unified, fully integrated Central SCADA Platform with Interactive loT and HMI Dashboard. The report meant to provide a brief overview of the architecture and framework that has been envisioned by the SCADA Committee for deploying the ideal solution at Dhaka WASA. This automation guideline was meant to guide water production and distribution monitoring and control processes mainly.

The following were the scope of work for that committee:

1. SCADA Software Specification Preparation
2. Detail specification preparation of required field devices
3. Specified of Standard Communication Protocol
4. Proposed common platform to integrate DTW, Meter, Valve and Treatment Plant's SCADA or non-SCADA data.
5. Compatibility assessment of existing piloting SCADA.

Although I was not a formal member of the committee, as divisional head of Planning and Design (Electrical & Mechanical) division I worked with the team, joined their meetings and gave inputs into the planning.

**4.2 What is SCADA:**

**4.2.1 SCADA stands for: Supervisory Control & Data Acquisition**

* It is a technology to collect data and monitor the performance of production and distribution processes.
* It is an application that can help to increase efficiency, lower costs and increase the profitability of operations by turning data into information.
* Reduce manpower needed for operation and monitoring activities thus reducing costs.

**4.2.2 Components of SCADA:**

SCADA encompasses two components:

Component 1:The first component is the **equipment** that is installed in water distribution network we want to monitor and control.

Component 2: The second component is the network of intelligent devices called Remote Terminal Units (RTU) and/or Programmable logical controller (PLC). RTU’s and PLCs are able to send and receive information for monitoring and operation.

* + 1. **Activities of a SCADA System:**

1. Data acquisition through sensors
2. Data transfer using communication network
3. Data processing and data or information presentation
4. User authentication and user access control
5. Instruments Control
   * 1. **SCADA system parameters for measurement and control:**
6. Pump on/off & pump running time
7. Power consumption
8. Chlorine cylinder full or empty
9. Pressure & flow
10. Failures & pump malfunctioning
11. Water level in well/ Dry-running protection system
12. Water sensor in DMA chamber etc.
    * 1. **SCADA system outputs:**
13. Alarm analysis
14. Trend analysis
15. Periodic reports etc.

**4.3 Existing Status of SCADA:**

Present and future use of SCADA:

At present DWASA uses SCADA mainly for:

* “Visualization” = see what is happening, monitoring.

In future DWASA can use SCADA for

* “Automation” = work with data in a more comprehensive way and operate remotely, example – Automated or semi-automated control of a pressurized water network.

In 2017, Dhaka WASA started the piloting project work for DTW (Deep Tube Well) SCADA, and has covered 163 out of 913 DTW under SCADA systems. Around 8 (eight) company was done this work. Above them 77 DTW has done by one vendor and he had sold the License software to Dhaka WASA and also found that the software is not perfect to fulfil WASA requirements. All SCADA are running under the vendor-controlled demo software. Vendors used several different field devices as well as different demo software which is running at vendor end. On the other hand, total 23 used such communication device which are infeasible to integrate into central SCADA.

Two type of standardized Demo software was used named Rockwell Talk View and SIEMENS WINCC software. On the other hand, one company had used own developed customized software which is cloud based hosting.

Water Treatment Plant SCADA: In Dhaka WASA, Three WTP has used SCADA for Plant. All SCADA brand are Schneider.

**4.3 Dividing the Requirements:**

The Committee divided WASA's requirements for SCADA automation for smart water management into 4 parts

Its compatibility from Deep Tube Well, District Metered Area and Water Treatment Plant - all the way to Central SCADA will be possible as long as standardized along international best practices. The four requirements are described with their functionality as below.

1. Field Devices
   1. Collect data from Field
   2. Monitoring Status of Equipment
   3. Control Equipment
   4. Communicating with remote station
2. Communication Network
   1. Used protocol to communicate or send/receive data
   2. Between field devices and Central SCADA
3. SCADA Software Platform
   1. Application Data Acquisition & Supervisory control by Zonal Personnel
   2. Device Configuration
   3. Central data preservation and distribution
   4. Template creation for operation and management
4. Common Infrastructure and Computer-network hardware
   1. Establish Data center or operation room
   2. Establish communication tool
   3. Install software
   4. Establish video wall

**4.4 Compatibility assessment**

DWASA aims to integrate of the existing SCADA with Central SCADA. Future expansion and up-gradating will be made under proposed system.

Following challenges were determined-

1. Current SCADA servers are located remotely on vendor’s servers or on cloud servers, not in Dhaka WASA office.
2. Each contractor implemented its own device and software.
3. No compatibility in Field Remote Terminal Units, Communication & Network.
4. Current SCADA software makes the integration into Central SCADA infeasible.
5. Dhaka WASA local office does not possess the ownership of the data and server control.

**4.5 Major Integration steps:-**

1. Micro-controller based system shall be replaced with PLC (programmable logic controller)-based system which have compatible communication system for hardware compatibility.
2. Electric meter, Water Flow meter shall be connected to PLC in order to maintain records of power consumption and water supplied.
3. Old software cannot be integrated into new central SCADA. Only hardware can be saved through required modification to certain degree.
4. Those are general requirement. Individual system in each DTW shall be closely examined to determine required modification and/or replacement in order to integrate to zonal or central SCADA.

The SCADA & TELEMETRY system (Supervisory Control and Data Acquisition) is a

complete system consisting of hardware and software, whereby information regarding

the status of pumps and regulation valves, flow rates from pumps and distribution pipes,

pressures in the network, water's level of PTWs, water consumers consumption in Dhaka

is sent to a central server (computer) in the local and central offices of DWASA.

With this information, DWASA has insight into the water balance within the distribution

network, and should it be necessary be able to take corrective measures to control the

flow and pressure through the DMAs of Dhaka city.

DESIGN CRITERIA FOR INSTRUMENTATION, CONTROL, AUTOMATION AND SCADA SYSTEMS

Electronic instruments shall utilize solid state electronic components,

a)

integrated circuits, microprocessors, etc., and shall be of proven design.

b

All instruments shall be suitable for continuous operation;

C )

All digital outputs shall be volt free;

d)

All instrumentation systems for use out of doors shall be protected to IP 65

for sensors and transmitters, while enclosures under submersible

conditions shall be protected to IP 68;

e

all analogue displays shall be of the digital type with no moving parts

utilizing back lit liquid crystal diode technology;

f)

For transmitting instruments, output signal shall be 4-20 mA DC linear

having two wire system.

Unless otherwise stated, overall accuracy of all measurement systems shall

be 10.5% of measured value, and repeatability shall be 10.5%.

After a power failure, when power supply resumes, the instruments and

h

associated equipment shall start working automatically.

The instruments shall be designed to permit maximum interchangeability

of parts and ease of access during inspection and maintenance.

The instruments shall be designed to work at extremes of the ambient

conditions of temperature, humidity, and chlorine contamination that may

prevail. The instruments shall be given enough protection against

corrosion.