RESEARCH ARTICLE   OPEN ACCESS

A Novel Prototype Model for Monitoring the Factories Remnants on Nile River

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Abstract
The environment faces too many issues including the water pollution problem in the Nile River. This problem could be solved by having a system provides the factory with the control and monitoring to be able to monitor and treat their water remnants according to the standards required by ministry of environment.
This project will establish and design a new control system that could be used by factories for monitoring and controlling their remnants.
The project based on using an interfacing device for facility management technology (eWON), and also Supervisory Control and Data Acquisition System (SCADA), that support General Packet Radio Service (GPRS) for remote data connection.
Key Words and Abbreviation: Supervisory Control and Data Acquisition (SCADA), General Packet Radio Service (GPRS), Industrial Control Systems (ICSs), Remote Terminal Unit (RTU), Transmission Control Protocol (TCP), Internet Protocol (IP).

I. Introduction

The Nile River had a bad impact from factory remnants. There are more than 700 industrial facilities that each day dropping a large amount of their remnants in the river without full supervision from the ministry of environment. Industrial waste water can be highly toxic and contain heavy metal that can have a very bad effect on the Nile causing water pollution. Moreover there are many zones near factories that drain in the Nile. These zones are called "black zone" in which no living creatures can survive.
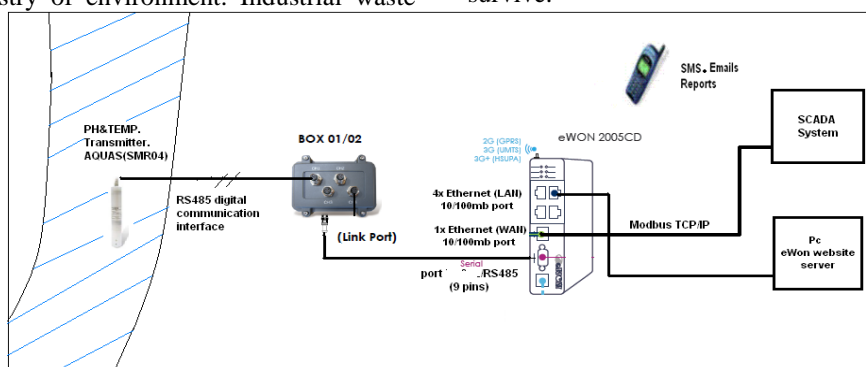

Fig.1 Schematic diagram for the prototype design model

Industrial Control Systems (ICSs) and Supervisory Control and Data Acquisition Systems (SCADA) are often found in industrial sectors and critical infrastructure. The control system is a device or set of devices to manage, command, direct, and regulate the behavior of other devices or systems. ICSs are typically used in industries such as electrical, water, oil and gas.

As shown in figure1 the proposed design is based on using interfacing automation device for facility management eWON technology and Supervisory Control and Data Acquisition System (SCADA), also with General Packet Radio Service (GPRS) for remote data connection, PH sensor, temperature sensor, Modbus Remote Terminal Unit (RTU) and Transmission Control Protocol/Internet Protocol (TCP/IP).

The main objective of this design is to make a system that improves the measurement accuracy and which reduces the amount of human resources required to manage and accomplish the measurement process. By incorporating the new technology, our costs will be reduced.

This prototype model will propose a newly optimized design that serves the factories to monitor their remnants according to the standards requested by the ministry of environment [1-4].

II. System Design and Layout

The initial design of the project will be shown in figure 2. The figure shows the hardware and the software that will be used to monitor the remnants of factories in the Nile River.

Sample of the remnants will be checked by the system based on the criteria requested by the ministry of environment, and a message will be sent by the ministry of environment to the factory for any miss matching standards that should not be accepted before draining into the river.

2.1 Software and Hardware Requirements
2.1.1 Hardware Components

1. PH & Temperature sensor AQUAS (SMR04) [5].
2. BOX 01/02 RS485 Extension box [6].
3. eWON industrial router module (2005CD)[7].
4. Power Supply.
5. PC for MOVICON SCADA.
6. Antenna

2.1.2 Software Requirements
1. Sensor Software [5].
2. eWON Configuration [eWON software] [8].
3. Movicon SCADA software. [9,10].
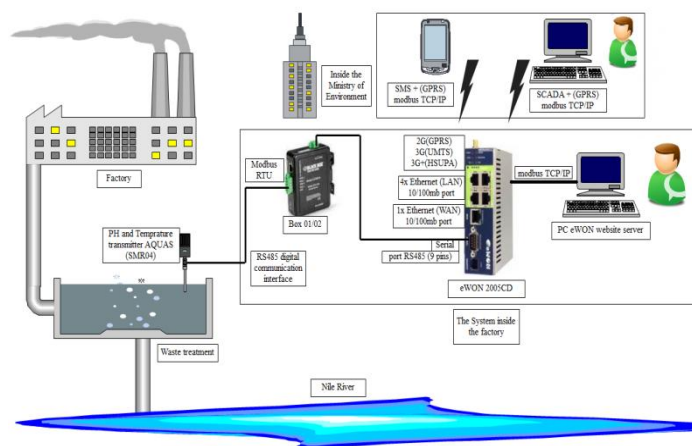4. TCP/IP & RTU (RS485) Modbus. [Used protocols] [11,12,13].

Fig.2 Prototype design and layout system

III. Operation Sequence

Sensing devices include PH and temperature will be used to check the PH level and the temperature of factory's remnants. The sequence of operations is described as follow:

1. The sensing devices will be connected through a multiplexer to (eWON) device using Modbus RTU through RS485 digital communication interface.
2. eWON device will be used for data acquisition, monitoring, networking and wireless or mobile communication.
3. eWON device will be optionally connected to either the (SCADA) system or the website through Modbus TCP/IP.
4. Supervisory Control and Data Acquisition (SCADA) system will be used for monitoring, also the data could be sent to any website.
5. Mobile communication devices could be used to transmit remotely all the specifications of the water remnants pertaining to any factory just to inform them about their remnants status and to let them readapt the status according to the standard required by the ministry of environment.

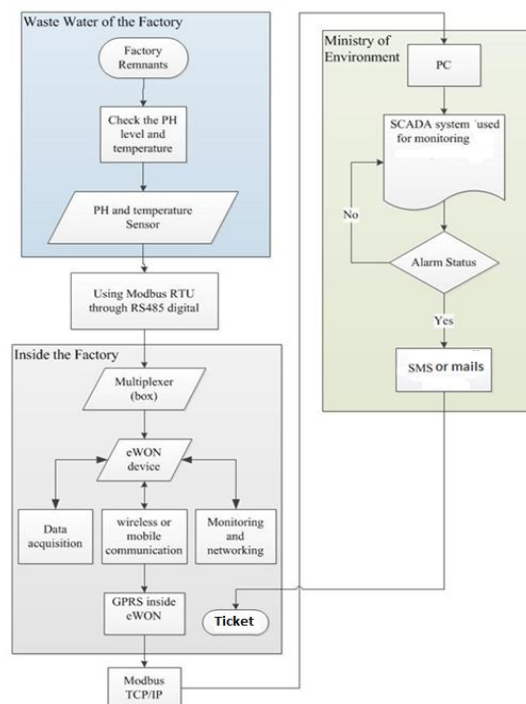Figure 3 shows a descriptive flowchart for the Sequence of Operation

Fig 3 Flowchart for the sequence of operation

IV. System Commissioning and Testing

Figure 4 shows a snapshot of the connecting hardware modules for the prototype supervision model. The hardware includes PH, and Temperature sensors, BOX 01/02, RS485 Extension box, eWON industrial router module (2005CD) and power supply. The system is connected to a personal computer loaded with the software for configuring the industrial router eWON and to construct the required tags and alarms defined by each application. Also the Movicon SCADA software is loaded and configured on the same personal computer. The System has been tested by sending a message constructed by eWON alarms to a mobile phone. Figures 5,6,7,8 show respectively the snapshots for the sequence of generating tags, alarms, and messages that will be sent to a mobile phone .Figure 9 shows a snapshot for one screen constructed on the Movicon SCADA to report the status of the PH sensor.

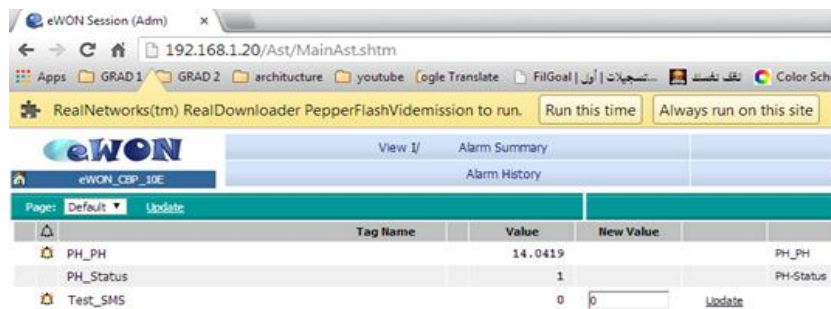**Fig. 4 A snapshot of the hardware connection for the Prototype Model**

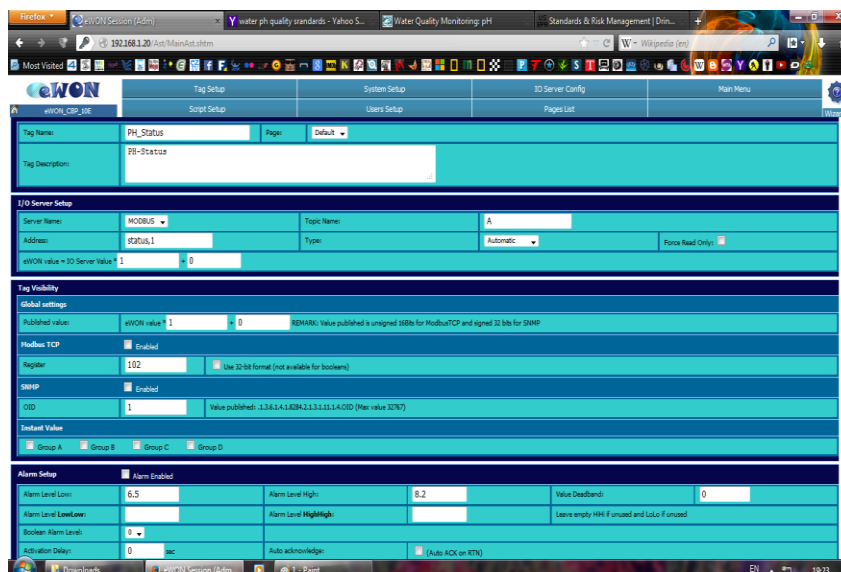**Fig.5 A snapshot showing the testing tags inside eWON program.**

Fig.6 A snapshot showing how to build the PH tag and also showing how to make alarm system in eWON.
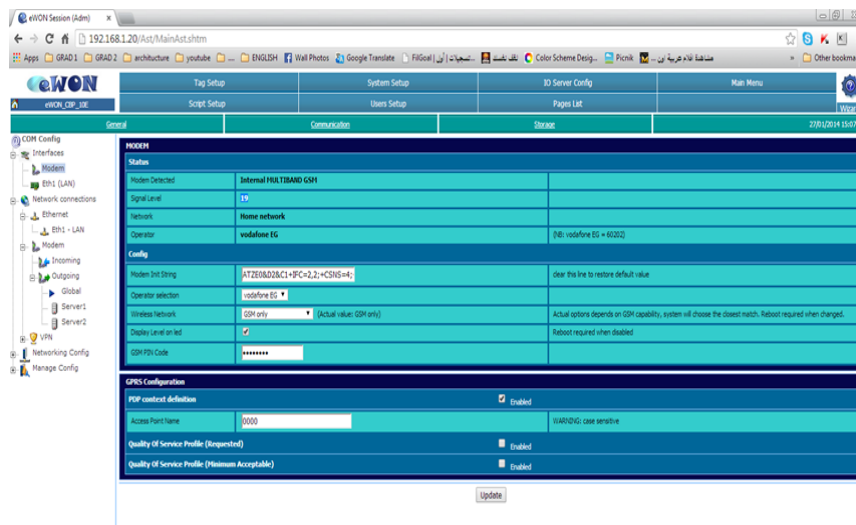
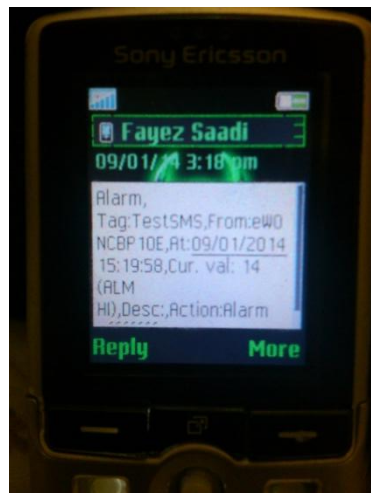**Fig.7 A snapshot showing how we can control all the details inside the SMS**

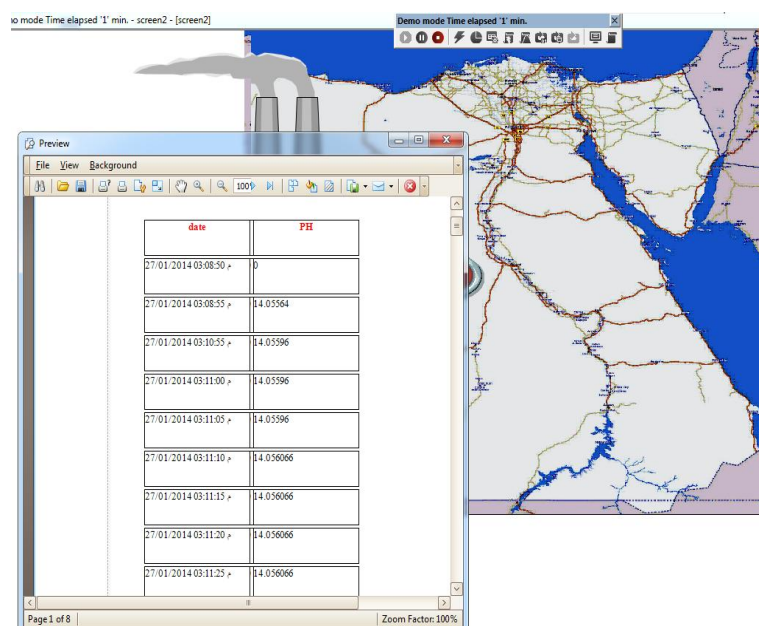**Fig.8 A snapshot showing an SMS Alarm sent by eWON to my mobile**

Fig. 9 A snapshot for one screen of Movicon SCADA showing a report of on-going status for PH sensor

V. Cost Analysis

Table 1 shows the economic analysis of the proposed supervisory monitoring prototype system with only two sensors the PH sensor and the temperature sensor.

Name	Amount	Cost ($)
eWON 2005CD	1	800
PH& Temperature sensor	1	500
Movicon SCADA	1	250
Others	-	100
Total		1650

Table 1 Economic analysis

VI. Conclusion and Future Work

Industrial Control Systems (ICSs) are getting more advanced and will the engineers to develop different applications due to their abilities to do almost whatever the "computers" can do. Remote management and control of devices is one of the areas where an application can be developed to enhance factories quality.

Factories inside Egypt have old control devices to control the remnants on the Nile River. Moreover, the ministry of environment doesn't have a complete idea about the levels and details of the remnants of those factories.

One of the unique things of this project is that it could provide all the details and data related to any factory located on the Nile by sending the data using the General Packet Radio Service (GPRS) technology to the ministry of environment.

The project has presented a real solution for water pollution spread across the Nile. By connecting the ministry of environment with all the factories across the Nile it would be able to watch the different levels of PH, conductivity, temperature etc.

The project has introduced a new flexible design that addresses the ongoing activities in the water by using special kind of sensors connecting to the (eWON) industrial router, both using wired and wireless communication systems. Also it supports monitoring and control by using Supervisor Control and Data Acquisition System (SCADA).

This system could be extended to include many other sensors to measure a wide range of the different parameters requested by any application in the industrial field.The future work will be dedicated to convert this prototype model to a pilot project that could be utilized and tailored in many different applications that serve both the industrial and the environmental fields.

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