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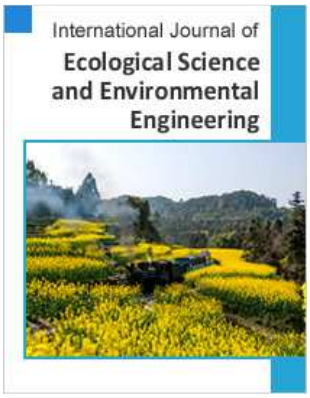

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Remote Management System of Water in Northern Morocco

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Abstract
The drinking water systems are subject to a number of failures given the state of the pipes, the nature of the land and to be monitored for economic and environmental leaks, spills, pipeline ruptures, Backflow. Hence the need to use new techniques including automation and computerization by using GIS (Geographic Information Systems) and automated monitoring station taking into account GSM (Global System for Mobile communications) or the RTC (Radio Transmission Control) transmissions. We find that the remote management system is the set of tools, electronics and telecommunications, allowing the management and control of technical facilities geographically dispersed such as potable water systems and sanitation. It enables remote monitoring facilities, remote control equipment and provides a set of tools to aid in decision-making.

1. Introduction

The main issues related to remote management in Morocco is the lack of studies on the Moroccan experience in remote management of water systems and sanitation, scarcity of literature on the remote management that is an area that uses a large number of disciplines, and the importance of the project design phase of remote, in fact, it is during this phase of the project are all great choices for the application to be in place, which obviously affects the cost and technical performance of the project.

This study aims to characterized the system of remote management in the region of northern Morocco and provide some answers to these concerns, a literature review on the remote management, which allows a considerable gain of time effort and cost of relocating staff affected by network problems, other advantages such as minimizing the leakage of water systems whose purpose is to generalize this innovative system in all sectors.

2. Materials and Methods

A. Selecting a template description of the system adopted

Remote management can meet the different needs of many application areas such as: Industry, environmental engineering, technical management of the building, irrigation, environment, public lighting, sanitation and water resources [1].

It includes all equipment and products that implement the information technology telecommunications and electronics [2], at the end to allow continuous monitoring of remote technical facilities distributed geographically and sometimes isolated. [3].

In case of northern of Morroco the works managed are spread over a large area from

three provinces: Tetouan, Chefchaouen and M'diq-Fnideq [4].

The system described provides operators with a set of functions essential for such remote management: remote alarm, remote monitoring, remote control, remote management, automation, communication between sites, TV reports, and archiving.

And allow respectively to alert services automatically in the event of failure or malfunction, to continuously monitor the operation of facilities, to measure real time metering data on the site and categorize and store all information received from various sites [5].

The choice of medium of communication is defined as appropriate, or to the GSM (Global System for Mobile communications) or the RTC (Radio Transmission Control) to reduce installation costs and operations which are usually associated with the use of radio transmission (Fig.1). The use of the network associated with the memory capacity of equipment used to record information continuously monitored at each site and not to transmit information only when needed (detection alarm, command start / stop equipment, transfer of data stored on each site) or a user request [6].

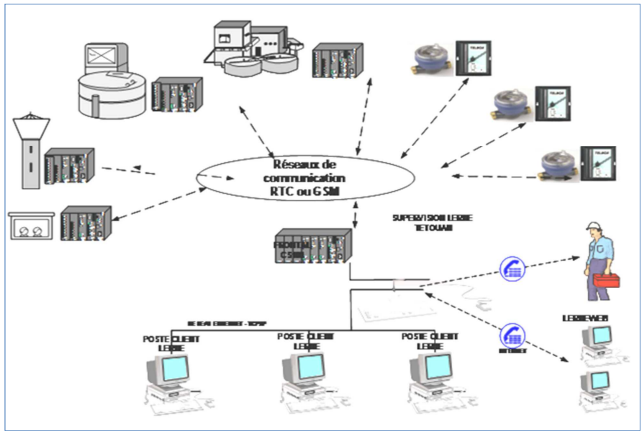

Fig. 1. *General Architecture diagram of a network of remote management.*

The remote management system in place is based in principle on local stations installed at various sites checked (reservoirs, pumping stations, boreholes, wells) (Fig. 2 and 3). They are installed in control cabinets (Fig.4). Some sites managed remote provide [7], [8]:

Fig. 2. *Local Post (automat) S50.*

Fig. 3. *Local Post (automat) S550.*

Fig. 4. *Fiberglass Electrical Enclosure.*

1) Information acquisition control (on / off pumps, number of starts, operating time, defects, level measurements, pressure, flow, counting pumped volumes, access control).
2) Control of hydraulic equipment (pumps, valves)
3) Information archiving (logs, historical balance sheets daily).
4) Inter-site automation (optimization of pumping based on electric rate periods, remote).
5) Transmission information to the center of the centrally managed remotely.

The central post for the centralization of network information [9] is responsible for receiving information from various local stations and periodic polling. The information received is stored in a database to be restored in the form of synoptic charts, tables of values and curves through a software interface Lerne 32.

The data from the remote management are transferred to Excel for use by other applications running on Windows. The central station also provides management with centralized remote alarm messaging to speech or SMS to mobile phones of staff on duty.

The autonomous local stations (Telbox) or (Cello), are installed on the counters controlling the distance or sectoral index counters, flow and pressure measurements (Fig. 5, 6 and 7). [7], [8], [9].

Fig. 5. *Autonomous local station.*

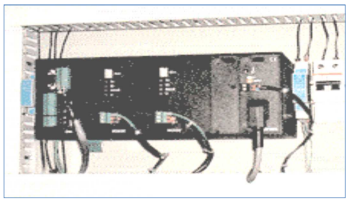

Fig. 6. Independent local station.

They operate independently and can transmit distance:

1) The daily distribution rates for each quarter hour.
2) Be provided automatically in the event of a leak or rupture of the water supply.
3) Record and process data automatically.
4) Systematically transmit all information to the frontal P-Mac.

B. Software interface

System is governed by three main programs:

1) Lerne 32 system.
2) Software for programming and management of PLCs (Programmable Logic Controllers).
3) P-Mac for the management and operation of flow meters sector.

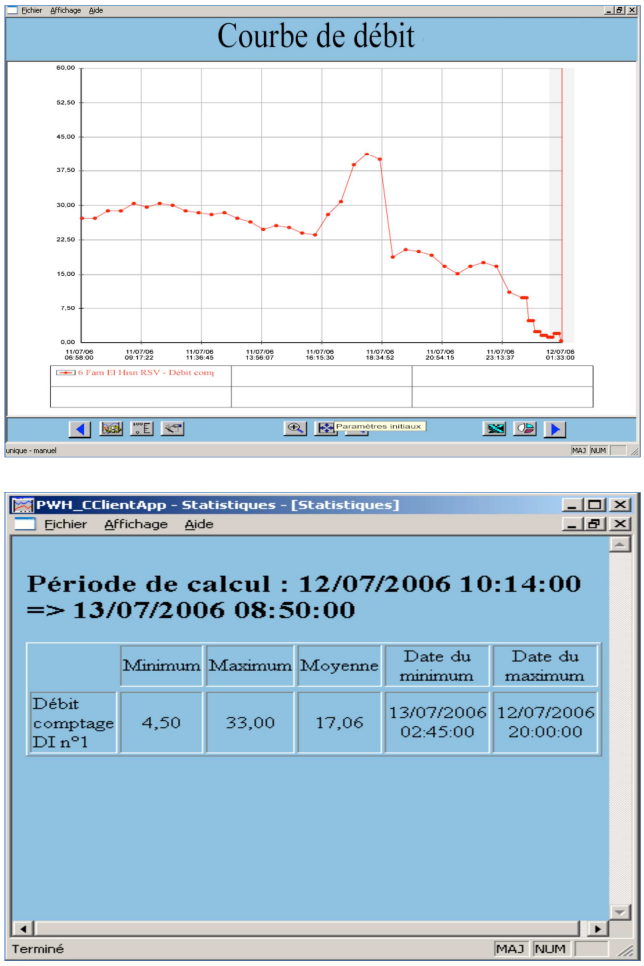

Fig. 7. Location decided to implement a remote management system.

3. Results and Discussion

A. The results of remote management on leaks

In addition to the benefits to gain considerable time, effort and cost of relocating staff affected by network problems, the remote management system provides multiple possibilities for the continuous monitoring equipment as the daily balance and interpretation of tidal curves tanks, saving energy and costs [10], and for optimization of network operations there assistance for find the leaks through various reviews, [11], and monitoring and action focus of the behavior of all networks.

Amendis Company has got delegated management [12], including distribution of drinking water and sanitation in the region of Tetouan, Tangier and Larache (Fig.8). To improve control and remote management of the works, she has decided to implement a remote management system, consisting of a Lerne 32 Server (Fig.9) used for the operation of all water facilities and sanitation. It meets the needs of conduct and monitoring of structures and to optimize plant operations by acting on the automation and remote controls. Running Windows provides access and exploitation of local stations as well as creating, viewing and saving their configuration.

It offers the following operating functions retrieval of information, locally or remotely with direct filtering of information, establishment of the curves on historical data transfer to Excel, and managing a data storage lifts.

Also five client: two fixed positions in the city of Tetouan and three positions in the main branches of the coastal zone (Fig.8).

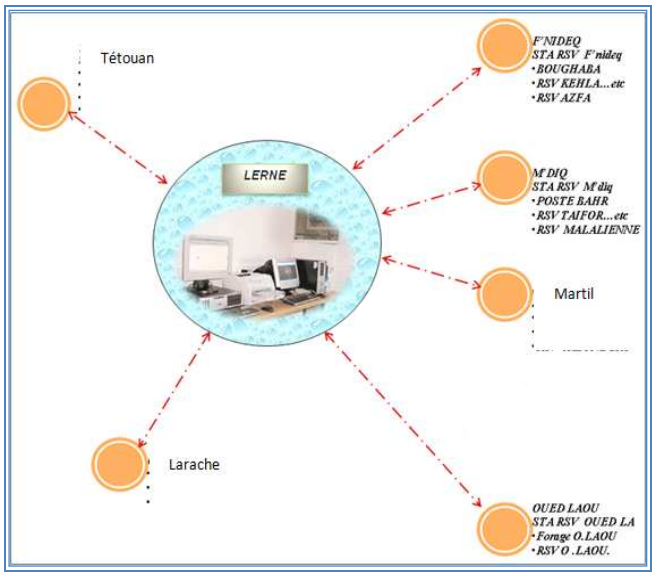

Fig. 8. Location decided to implement a remote management system.

Two printers one laser printer and one for monitoring the course of the water. A front teletransmission equipped with interfaces support communication with local stations via modems and PSTN (Public Switched Telephone Network) with a serial server Lerne 32 speech and communication alerts to agents on call [13].

There is also a communication card MODEM / RTC or GSM MODEM DATA / SMS with antenna, a communication card series for positions in GSM, a rectifier battery takes over in case of power failure, and a cabinet comprising the entire above item with the necessary protection [14].

Fig. 9. *Lerne32 system.*

B. Instructions for operators

In order to maintain the progress of activities, there are tasks to be performed by operators whose their roles and characteristics to be checked at each site are listed in Table 1.

Table 1. *Roles of operators and characteristics to be checked at each site.*

Items to check for each site	Role of operators
• Level of the tank, inflows and outflows. • State of electro-mechanical equipment, pressures on returns, networks and electrical state of the site • Intrusion, automatic pumps, regulation of inflows and chlorine.	• ***Follow*** the progress of all actions and statements that mount to the client PC and direct treatment by the system Lerne 32 (access stations, viewing the form of curves or tables) Or using different Windows applications (generation of tables or Graphics EXCEL table). • ***Querying*** works and support the issuance of instructions (All information is stored for a period of one month on the server's hard drive and Lerne 32 are listed on a printer over the water. Archives are engraved in automatically archive folders programmed into the client).

C. Instructions for administrators

Concerning the progress of the system Lerne 32 and local stations, each responsible has a role to ensure monitoring of activities, the Table 2 listed the different roles of system administrators.

Table 2. *Roles of system administrator and local stations administrator*

Role of system administrator (Lerne32)	Role of the local stations administrator
• Install and update sites. • Prepare applications and operating reports (flow, energy, pump operating time). • Make block diagrams of structures. • Ensure communication between sites, the central station and operating instructions installed site. • Realizing the system maintenance and check correspondences configurations exported to Lerne 32. • Save data Lerne 32 and the main client. • Change the settings if necessary (depending on season). • Seek to optimize the works and to develop facilities.	• Check the installation and configuration of the automt. • Check the installation of sensors and batteries. • Ensure communication between the local station and the central station. • Ensure the values read by the local controller and the values passed. • Reprogram machines if necessary (according to the instructions and seasons). • Make maintenance of local stations and sensors. • Commissioning the new site. • Setting local connections and automation.

D. Look for leaks

With performance analysis and volume loss, calculations will be made to determine whether to start an action for leaks.

A campaign of leaks detection is only profitable if expenditures (expenditures for leaks themselves, but also repair leaks identified) to improve the efficiency savings are less than the cost of production and distribution driven by this improvement.

It is impossible to try to reduce any leaks (the cost would be prohibitive). However non-economic reasons can justify the reduction in levels of leakage.

E. Repair leaks

It is important to repair leaks as soon as they were detected to minimize their impact and inconvenience to users, but also

in terms of organization of service interventions.

On the other hand, the flow and noise of the leak would not jeopardize future research more, and assessments will be made as and when the leaks are repaired.

F. Monitoring central station

Remote monitoring system Lerne 32 is based on information arriving from each book or reservoir (local post). It is provided by operators performing a rotation system during the day (8 am to 23 pm) from the desktop PC and continuously monitored by officers on duty (24h/24h).

4. Conclusion

The remote management system in place at the Northern Morocco uses the GSM and RTC transmissions, this support is very advantageous because it significantly reduces costs. Also significant savings have been generated as a result of reductions; operating technicians no longer have to make regular rounds to monitor the proper functioning of the structures.

Therefore this system offers many possibilities for analysis and simulation that allows the management of water resources and secondly to create an innovative computerized tool that will give significant results, and as a methodological tool to aid decision makers and managers of all kinds for the sustainable development action, because the computer systems are increasingly explored to solve the problems of resources management and spatial planning.

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