Control and Monitoring of a Regional Water Supply System

Facility Management
Macedonia

Project Introduction:

"Studencica" is a Public Enterprise, distributing quality drinking water to cities and villages in the central & western regions of Macedonia, having a total length of more than 130km of main pipeline.
The goal of the project is to centralize the measurement of water consumption and remotely control the water flow level in each node (branch), as well as to collect all the information about the status and alarms from the actuators.

System Requirements:

In a regional water supply system, many different users (like municipalities, villages, industrial enterprises, and power plants) are connected directly to the same system, and they all expect good quality water everyday. A Centralized Control and Monitoring System has to be established in order to provide the same level of water to every user at all times, especially during dry periods, which can last for many years.

By the implementing a Centralized Control and Monitoring System, the customer hoped to achieve:

- Precise and centralized measurement of the water flow in all main branches and supply points at all times, with the ability to measure water usage during specific fiscal periods.

- Depending on the available quantity of inlet water from the wheels, and based on the predefined government approved water distribution laws, the central computer remotely regulates the water flow at each node, providing an exact quantity of water to every user, so that no one branch gets a higher privilege.

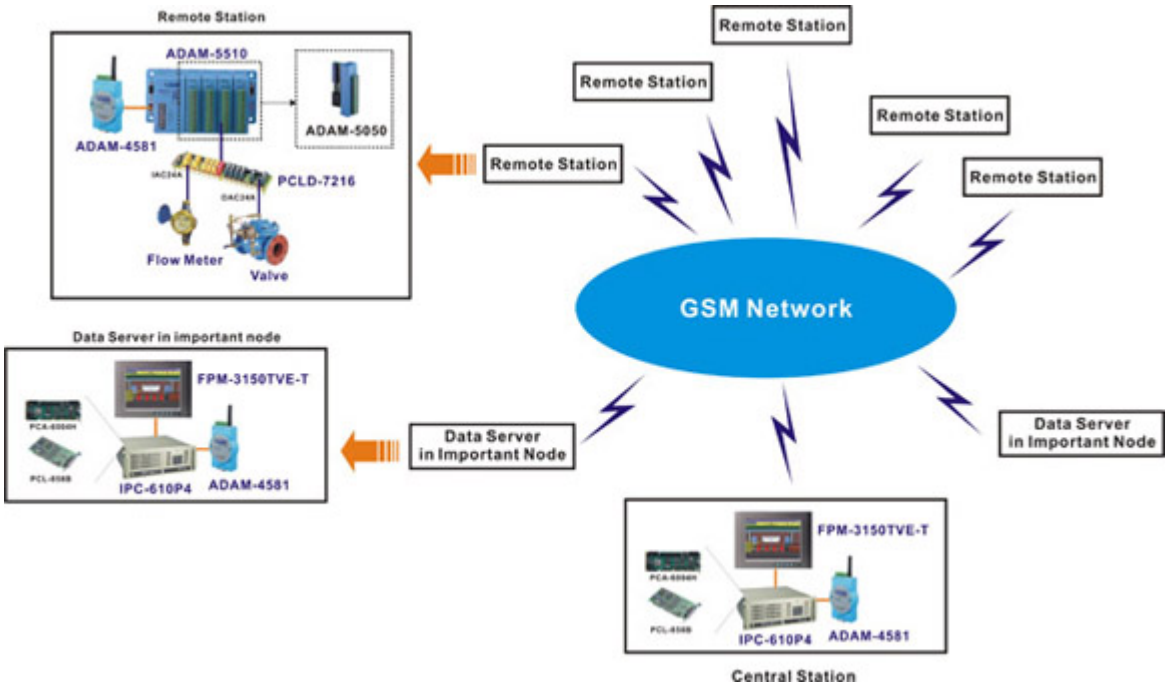
The overall enhancements of this system should also include:

- Dramatic reduction of staff required to operate the system.
- Reduction of the operation and maintenance costs.
- Improvement of the security and safety of the equipment, pipeline and water.

Project Implementation:

- ADAM-5510: PC-based Programmable Controller
- PCLD-7216: 16-ch SSR I/O Module Carrier Board
- IAC24A: AC Input Module (180 – 280 VAC)
- OAC24A: AC Output Module (24-280 VAC)
- ADAM-4581: 1-port GSM to RS-232/422/485 Data Gateway
- IPC-610P4: Industrial Computer Chassis
- PCA-6004H: VIA C3 800 MHz (onboard CPU) Card with HISA/VGA/LAN/LCD
- PCL-858B: 8-port High-speed RS-232 Communication Card
- PCI-1752/54: 64-ch Isolated Digital/Input Output Card
- FPM-3150TVE-T: Industrial Flat Panel Monitor with 15" LCD in Direct-VGA Port with Touch Screen
- Special developed control algorithms and software provided by solution partner

System Diagram:



System Description:

A Centralized Measuring, Supervisory & Control System, this system is intended to operate automatically, with little manpower present. There are 24 main nodes in the water supply system, each with one or more branches. The nodes with more than two branches or those that provide data to the local Municipality are treated as important nodes. There is at least one precise water flow measuring instrument and one motor-operated valve in each remote station. With ADAM-5050 I/O modules, ADAM-5510 works as a local controller to read data from Flow Meter via IAC24A modules and controls the valve through OAC24A modules. It will create data log in its battery back-up memory for the measured values, events, valve status and alarms, and transfer all data to a data server via ADAM-4581. It will also transfer requested data from the central computer via ADAM-4581. With ADAM-4581 modules, local controllers or industrial computers in the whole system work inside of the GSM network. On the other hand, the Central Computer can send a new **Water Sharing Principle** to the local controllers directly or automatically for any changes.

Conclusion:

A water supply system is a very complex and complicated mode, consisting of a long main pipeline with many branches, valves, and hybrid mechanical devices. Though the physical elements are a long-term constant, it is difficult to set up a proper control mechanism for the entire system. Only PC-based controllers provide fast enough computing performance, adequate memory size, good communication interface, and simple programming languages to successfully reach the goals of this project. It is important to note that almost all controlled nodes are outside of urban areas where no wired telephone lines exist. That is why it was decided to go with wireless communication, using ADAM-4581 as the main communication device in a WAP/GSM network. Because there is no need for fast and frequent data exchange in this project, the communication charges in the system are very low.

A high-performance and reliable water supply control system was achieved, which can properly adjust water levels at all branches off of the main pipeline, and provide adequate water sharing between all users. Furthermore, its precise measurement and communication abilities decrease financial, operational, and maintenance costs.