COMPAX

International (93) Colombia LTD
a member of the **ORAD** Group

Scada water pressure project Bogotá

Low energy wireless SCADA solution in a metropolitan scale

The Bogota water and sewage company is the company providing these essential services to the Colombian capital to more than seven million inhabitants.

The company was looking for a SCADA solution that would have the following characteristics:

- RBE Data acquisition.
- Real time SOE.
- Monitoring.
- Reporting.
- Low energy consumption.

In order to answer all these requirements a special configuration was implemented. First the city was divided to five zones where each zone contains around seventy to eighty sites.

At each site there would be a cabinet as sown in the pictures:

Picture 1: outside view of a site

Picture 2: The actual cabinet

The Hardware

As can be seen each cabinet houses three main devices:

The RUG3 RTU, cellular modem and a WIFI server.

The RUG3 main specifications are presented here:

- 6 Analog Inputs.
- 8 Digital Inputs.
- 2MB of logging memory.
- 16-bit MSP430 CPU.
- 2 mA power consumption.

Each station needs to measure the following parameters: water pressure (the main parameter), battery Voltage, Temperature, intrusion and inundation. The system generates an alarm code in case one of these values is not within normal range.

Picture 3: RUG3 RTU

Choosing the correct RTU is essential part in a project of this scale, therefore an intensive market study was conducted. The RUG3 stood over others due to it´s extremely low power consumption (2mA at full load) moreover, it´s data logging support feature, a protocol allowing the usage of time stamps made this RTU the obvious candidate.

Communications

Each site is designed to operate at the most efficient manner possible in both terms of energy usage, physical costs and data costs. In order to achieve these goals the RTU takes the measurements every ten minutes and stores the data in its logging memory, the data however is only transmitted once every six hours. When this happens the RTU turns on the modem, the data is transmitted and than the modem is being shut down. This way the goal of energy efficiency is being achieved which results in very low maintenance costs.

In the case on an irregular value, such as low battery voltage, the rule of transmitting every six hours is being bypassed and data is transmitted immediately to the control station - Report by exception-RBE based protocol. Thanks to this protocol, a sequence of event (SOE) analysis can be generated.

Timestamp is being used in the system to maintain the requirement to real time data, as said before it is possible that six hours will pass between the actual moment of the measurement until the information is actually sent to the SCADA which may result in an inaccuracy because data that is six hours old would be regarded as current real time data. In order to avoid this, the RTU puts a timestamp after every

measurement. For example the data of a particular pressure measurement is shown as {timestamp, pressure, and alarm code}.

The Data that is gathered by the RTU is transmitted wirelessly to the zone server (as you remember there are five zone servers).The zone servers have several computers that are connected to them, these computers ,referred as workstations, are meant to limit the accessibility to the SCADA servers. The following picture illustrates the communications.
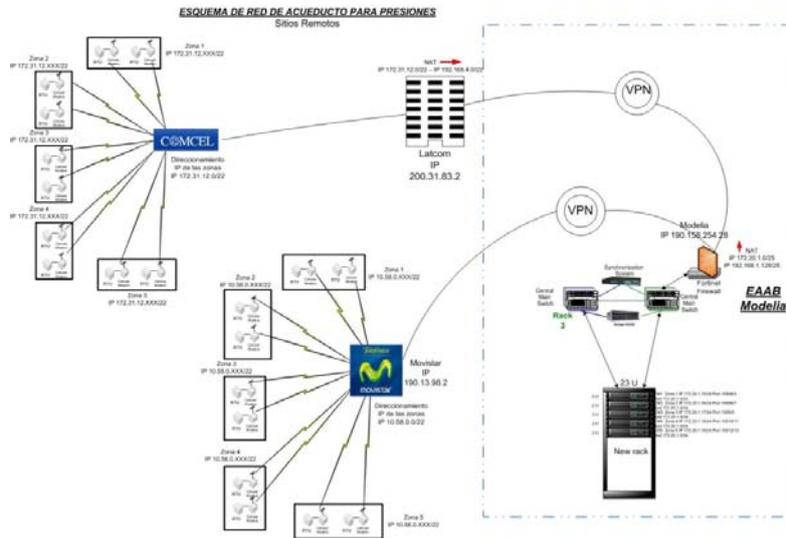
Picture number 4: communications scheme

Human Machine Interface.

The Data that is collected from the RTU comes in a RUG9 protocol. Compax has developed a driver that enables the use of this protocol in every HMI application that there is in the market. For this particular project Wizcon HMI was selected, the driver enables the connection of unlimited number of devices over tcp/ip without any communications errors or system overload.
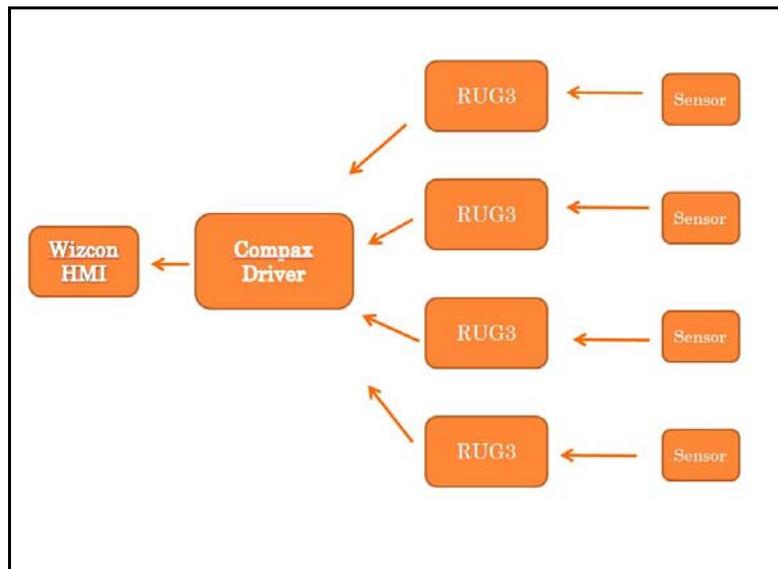
Picture 5: Scheme of the Compax driver.

At each zone server and workstations there is a WizCon supervisor application installed, through the application the operators can access the data (According their permission level). The application is built in such a way that each operator can see a general view of his zone, where the locations of the various stations are shown. Each location of the zone can be monitored more closely by pressing on it.

The following picture illustrates the workstation:
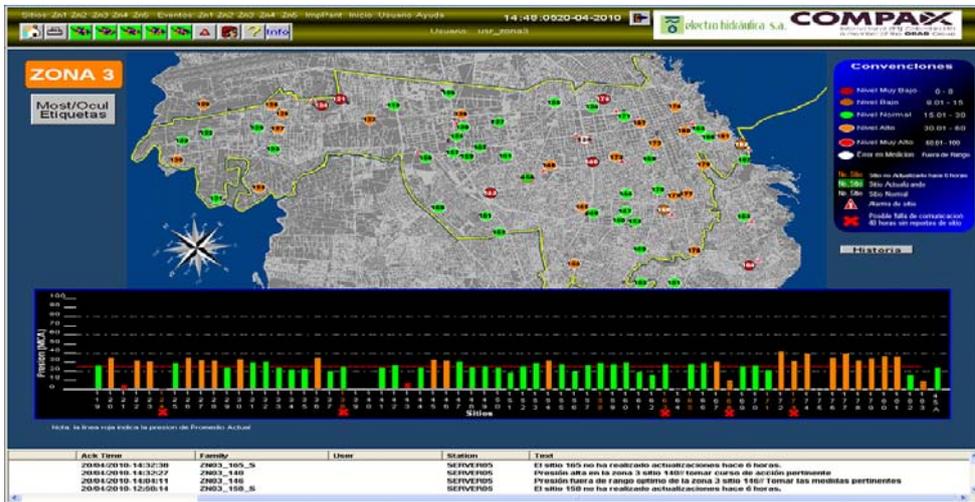
Picture 6: general view of a particular zone.

Picture 7: general view of a particular site.

Let´s examine picture number 7. At the upper part, the zone and site number are shown followed by the exact location, time and date. The middle part is the main part where the measured valued of pressure temperature and voltage are shown.

The alarms can be roughly divided to physical alarms and non physical alarms or alarms that are technical by nature.

Physical alarms such as: manhole cover open, cabinet open, water inside manhole

Non physical alarms such as: no communications, low battery, abnormal pressure etc…

Picture 8: various types of alarms.

The general view (picture 6) shows the zone view where each small dot represent a site. Right below there is a bar graph for each station with a red line showing the average pressure of the zone.

The bottom most part is the event log where alarms are being shown.

Reporting.

A designated SQL server is assigned. The server receives the data from the zone server and maintains a database. The system is a business intelligence using data mining to provide reports on demand. Compax has provided a Web Portal system meaning that authorized users can access the system from their home using nothing but a regular browser without the need to install any HMI system.
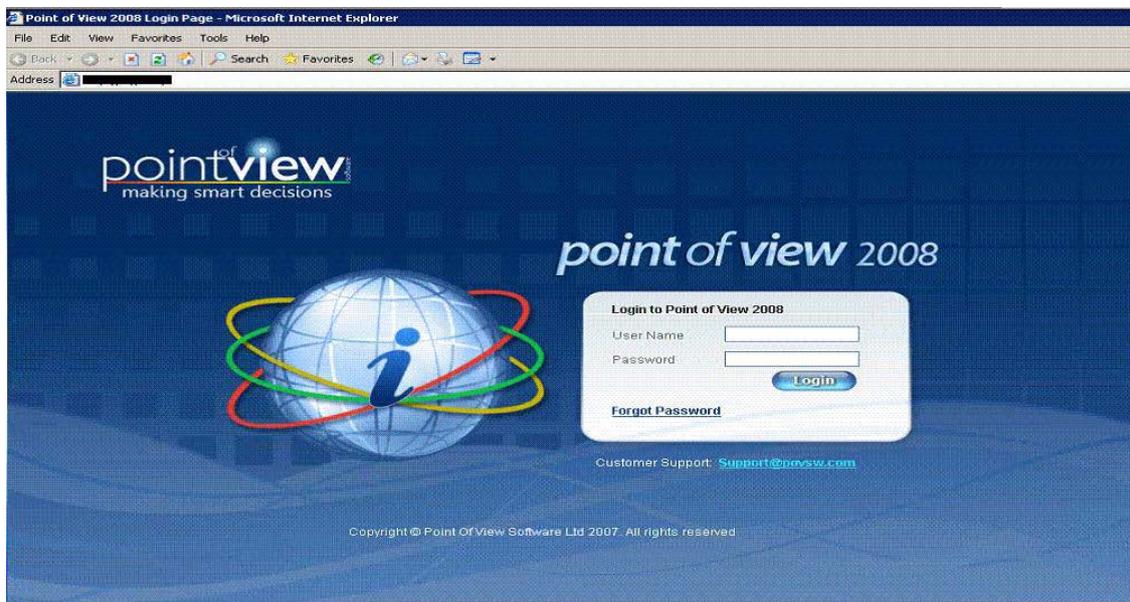
Picture 9: Web Portal system.

Reports are generated through Crystal reports one such example is shown in the following picture

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AGUA Y ALCANTARILLADO DE **BOGOTÁ**

**FORMATO ÚNICO PARA REGISTRO DE PRESIONES
MENSUALES EN DISTRIBUCIÓN**

Zona		No. Punto	Nombre	S.Hidraulico	Dirección		TagTimeStamp	TagValue
Zona	1	1	SAN JOSE NORTE	62	CLL 183 X CR 78	maximo	12/08/2009 01:22:09	42.87
						maximo	12/01/2009 00:37:34	42.86
						minimo	12/17/2009 10:26:34	26.62
						minimo	12/15/2009 11:18:37	26.61
Zona	1	2	MARANTA	61	CLL 186 X CR 56	maximo	12/07/2009 00:57:35	32.71
						maximo	12/08/2009 01:51:14	32.71
						minimo	12/18/2009 10:38:05	22.32
						minimo	12/08/2009 11:22:57	22.30
Zona	1	3	ALMENDROS	56	CR 115 X AV CLL 153	maximo	12/27/2009 01:54:24	42.48
						maximo	12/24/2009 01:44:15	42.47
						minimo	12/27/2009 11:46:04	17.11
						minimo	12/27/2009 11:06:04	16.96
Zona	1	4	CORPAS	56	CR 111 X CLL 154	maximo	12/26/2009 01:58:00	42.78
						maximo	12/26/2009 01:59:10	42.78
						minimo	12/27/2009 10:58:18	18.64
						minimo	12/08/2009 10:56:51	18.52

Picture 10: an example report.

This particular reports, belongs to zone 1, shows the site name (neighborhoods in Bogotá), the address time stamp and the actual value of the pressure measurement, other reports can be generated on demand.