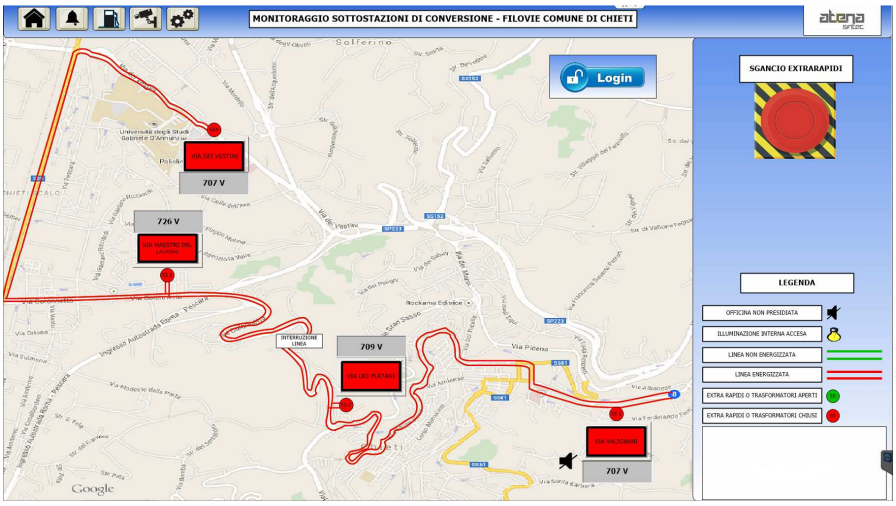
Automation of the local trolley bus service in the town of Chieti

Atena Sintec provides a local transport company with a solution to control the entire trolleybus route with four medium voltage power substations and protect the safety of its operators

The ATENA sintec srl company went into operation in 2014 as technological system integrators primarily offering solutions to the automation, remote control, telecommunications, energy and alternative energy sectors. The automation and remote control involve the design engineering, realization and maintenance of systems for the civil sector with smart building systems, the industrial sector with process automation and the public sector with management and rationalization of supply resources. Their telecommunication solutions enable dialog between the various systems that have been designed to enable remote control and programmed maintenance. They also provide solutions to extend connectivity with other systems based on the most recent technologies.

The Energy sector is of an important significance to them which they demonstrate by offering solutions particularly aimed at the industrial field where supply and distribution systems in BT, MT and AT are used. The Alternative Energy completes their agenda by offering energy solutions that concentrate on energy saving issues.

The trolleybus system user company has been operating in the public and bus hire sector for more than sixty years and runs the local, regional and long distance intercity bus routes in Abruzzo. The system designed engineered by Atena Sintec, controls the automation of the urban trolley bus route from S. Anna Square to the Clinicizzato Hospital in Chieti. The solution on which the project is based is composed of four MT (medium tension) power substations



1. Movicon screen used for monitoring the trolleybus line service substations

that supply continuous voltage along the trolleybus service route that is constantly used used by commuters. A control centre resides at the Via Valignani overhead trolley bus cable service station. The Client's main objective was to obtain full control of the entire trolley bus line which they managed for the safety of their workers.

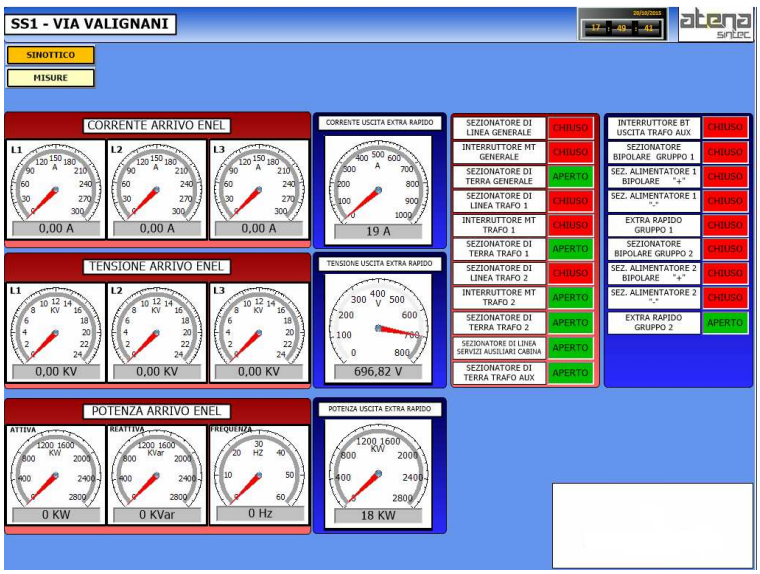
System description

A PC worksation has been installed at the Control and trolley bus line data processing Center along with six monitors to display difference screens and maps simultaneously:

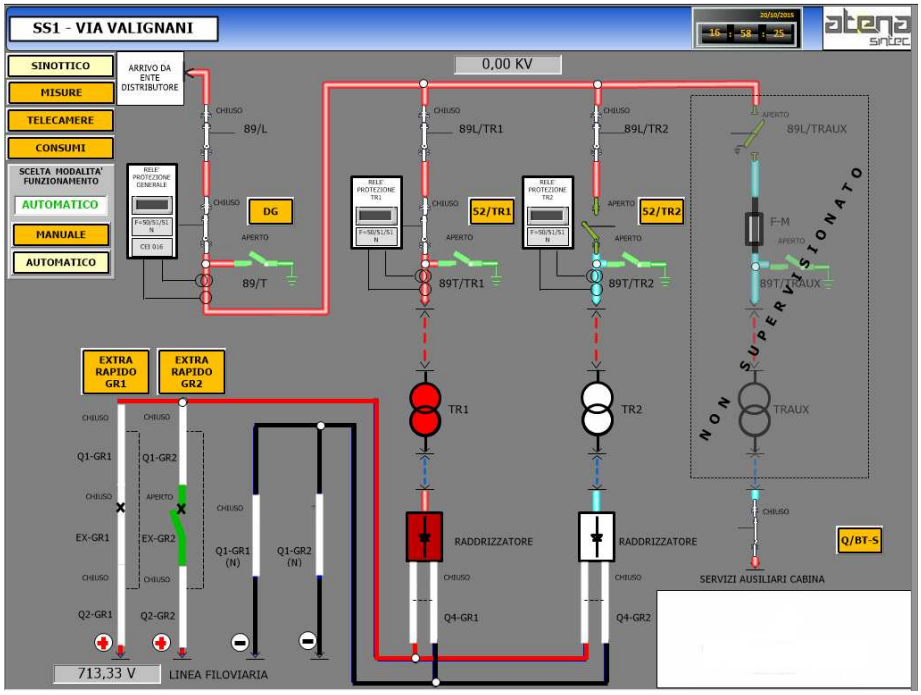
- Monitor 1, displays the main urban route with system error and failure alerts
- Monitor 2, displays a screen with the substation 1 electrics
- Monitor 3, displays a screen with the substation 2 electrics
- Monitor 4, displays a screen with the substation 3 electrics
- Monitor 5, displays a screen with the substation 4 electrics
- Monitor 6, displays the configurations and settings relating to the system setup

The system interface consists of the usual signalling of the current status within each of the individual substations with an automation panel/board equipped with telecommunication components that collect the status of connected inputs and transmits them to the Control Centre where they are displayed in real-time. Likewise the data is interfaced with the latching and unlatching commands of the electrical switching devices such as the medium voltage switches, low voltage input circuit breakers and high speed output transformers. Movicon 11 the SCADA software used in this project functions in two modes: manual or automatic according to whether an operator is present or not in the control station. In manual mode the opening and closing of the electrical devices can be managed, such as the main switch, high speed transformers and the auxiliary power units that power the trolley bus line.
The following real-time data is displayed on screen:

- Electrical measurements such as currents, voltages and power
- Status of the various circuit breaker and line selector switches
- CCTV cameras with images of the units and various substations



2. Screen used for monitoring the incoming electrical current, voltage and power measures

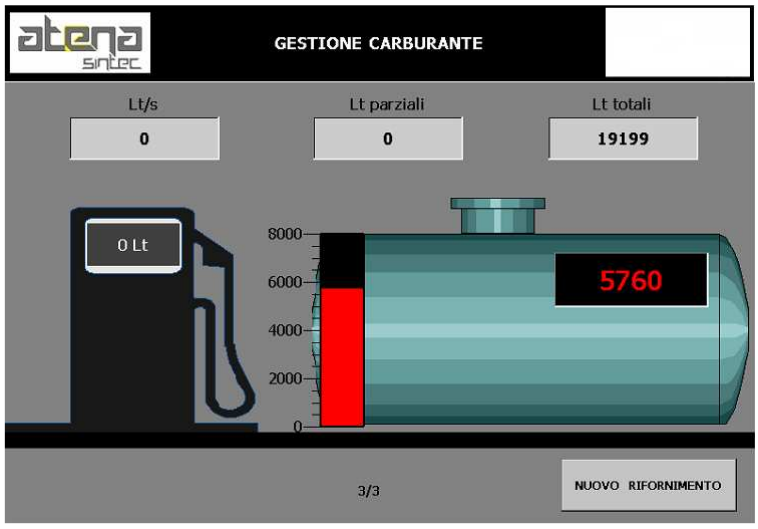


3. Movicon screen in automatic function mode

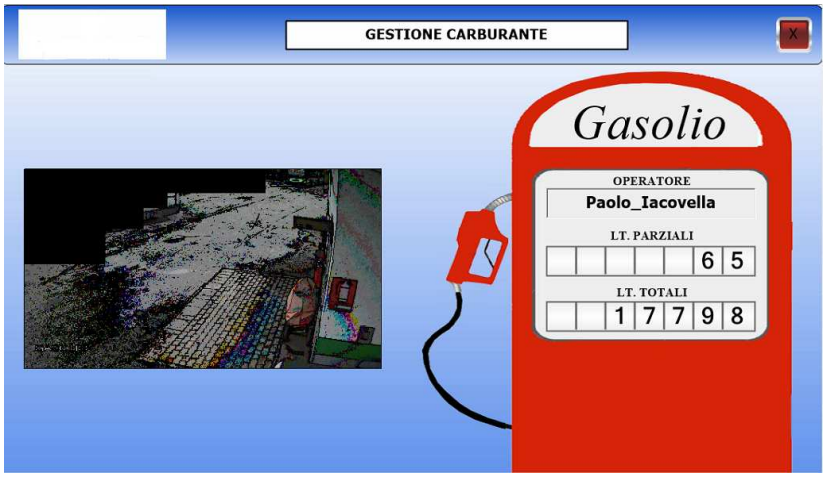
- Energy consumptions and confrontations of those from previous months
- Trends showing behaviours of data of interest within selected time ranges

Remote commands activated from the Control centre, are protected with user login with authentication recorded on log along with the actions performed.
The screen used for managing the alarms has been completely customized using script in addition to the classic alarm windows with a 'ALARM/MANOEUVRE' combo-box by means of which a screen showing events of alarms triggered by field variables and the manoeuvres performed by the operator as a consequence.
The software that manages the video camera recordings is accessed by means of using an ActiveX Interface and is restricted to the company director by using an associated Movicon user password level. As requested by the client, operations in the software can only be performed only after login has been performed correctly. This is because all operations performed by operators are recorded and traceable on database for immediate detection of error causes and their solutions.

Movicon 11 manages a daily and monthly summary of energy consumption and loss using graphical trends. These trends show the behaviour of specific data recorded and archived on database in order to consent data extractions for fixed periodical reports. These reports can be modified with the interpolation of different amounts of data recorded.
Movicon also provides a child project called "Fuel Manager" because the trolleybuses run on both diesel fuel and electric. This child project is solely dedicated to the diesel fuel supply of the trolleybuses and is in continuous communication with the control centre.
The operator can perform all the refuelling procedures with just a few clicks eliminating all paperwork that was used beforehand. The screen sequence permits the name of the operator and the current mileage covered by the trolleybus to be entered while its identity code is acknowledged by an antenna positioned at the beginning of the trolleybus route. A following screen permits the user to either select "FULL" or choose how many litres to fuel the bus with. Once the refuelling pump nozzle is released another screen automatically opens on the control panel, as well as in the control station, to monitor the fuel tank level by using a pressure transmitter and watching video camera images of the ongoing refuelling procedure.



4. Refuelling Screen



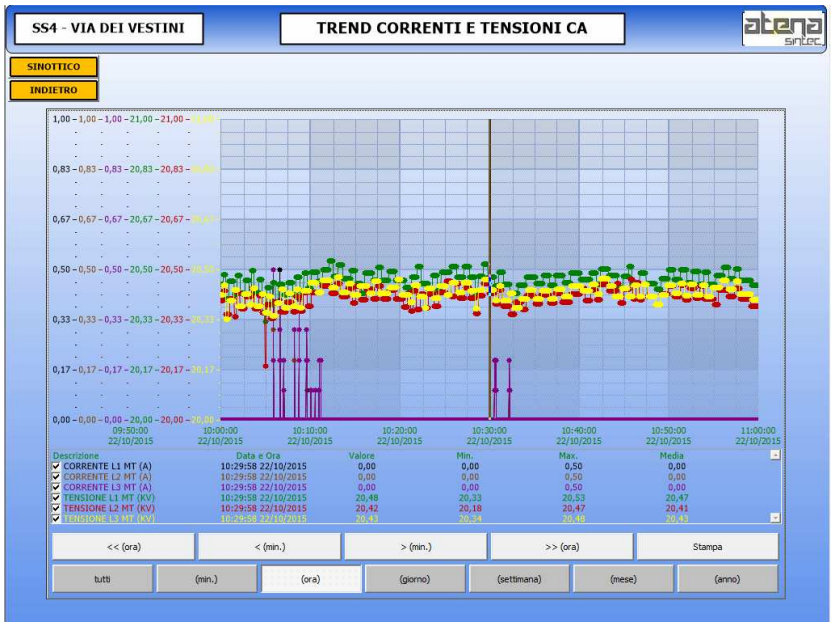
5. Fuel management screen

The system architecture

The telecommunications network between the different system components is based on the 10/100 Mbps Ethernet protocol which allows great flexibility to enable expansion over the coming years.
Communications between the substations and the Control Centre is ensured by a primary internet connection based on a point-to-multipoint wireless using a 5 Ghz bandwidth supplied by a local telecommunication operator. While a secondary internet connection has been configured with auto rollover and is based on a 3G router provided by a national operator. The substation devices and the Control Centre are programmed to automatically use a standby connection if the primary connection should become unavailable to then return back to the primary one once made available again. The Control Centre is equipped with a PC workstation and a multiple monitor on which the monitor and control interface is based on Progea's Movicon 11 SCADA software.
Therefore it is modular, expandable and extremely flexible to meet all client demands. The great level of customization achieved has made it possible to combine the high safety standards of the trolley bus service energy supply with the need to save on energy and quickly detect malfunctions.
Movicon 11 interfaced with the PLC for the substations' digital and analogic signals, the gateway is used for communicating with existing equipment using the RTU RS485 Modbus protocol while the other devices communicate with the TCP/IP Modbus protocol. As regards to the child project, Movicon interfaces with the PLC for the substations' digital and analogic signals and the gateway communicates with existing equipment using the RTU RS485 Modbus protocol. The integration of components that control the status of the environment, energy consumptions and the continuous and alternated electrical parameters, has enabled the extrapolation of data usage and the division of system performance into macro areas subdivided for each substation. This is the real advantage gained by using this type of architecture.

Conclusion

Atena sintec has decided to use Movicon mainly for its versatility and especially for its capacity to interface with devices of different brands. This characteristic has made it possible to satisfy the needs of various clients and existing systems in use. Due to Movicon's great flexibility and simplicity of use, it is possible to analyse and instantly resolve problems encountered in the system. Furthermore, Movicon is well supported by the Progea Technical Support team of highly qualified technicians who have helped reduced learning and response time which is considered the true



6. A Movicon screen displaying currents and voltages

added value of a software product.
The end result satisfied both the programmers and end client. “The project has always proven to be highly reliable and flexible despite having to manage a complex system that supplies energy to the trolleybus line,” commented Iannone Pierluigi from Atena sintec.

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