REMOTE CONTROL AND MONITORING OF FIRE ALARM SYSTEMS

Joaquín Del Río[1], David Sarrià[1], Alberto Hidalgo[1], Ramon Marimon[2]
1-SARTI Research Group. Universitat Politècnica de Catalunya (UPC). www.cdsarti.org
2-Fire Vision Technology S.L

Abstract- Most of the actual fire alarm systems used in small and medium size places in the market works as a standalone systems without the possibility of remote monitoring or configuration.
This article shows a new development that provided for one hand, an Alarms and Events Reception System (AERS) that provide remote monitoring of fire alarm systems status based on a LabVIEW application and an additional hardware installed on the fire alarm system providing internet access.
And on the other hand, the development of a web server embedded in the fire alarm systems providing system monitoring and configuration based on internet access.

FIGURE 1. Fire Alarm System

Introduction

Nowadays, most of the fire alarm systems, figure 1, are installed in places where the system works standalone and are configured and managed locally. The possibility of remote management and monitoring using internet access open to fire systems manufactures different possibilities to extend the services given to final users.

The development of a new alarms and events reception system using LabVIEW allows centralizing the management of a group of fire alarm systems providing information about real incidents, faults, manipulations, archive, etc…
On the other hand, the fire alarm systems equipped with the new hardware with an embedded web server are able to be programmed and configured remotely thanks to a developed JAVA web page that provide direct communication with the fire alarm system. In that case, when the alarms and events reception system is receiving information from some fire alarm system, the operator is able to access the fire alarm system and monitor what is happening remotely in order to discard false alarms or provide confident information if a real problem is detected.

System Description

The aim of the project is provide internet access to commercial fire alarm systems in order to be managed remotely. The fire alarm systems are commercial off the shelf devices, and no firmware or hardware modifications are allowed. Then the additional software and hardware to be developed in the project has to take into account this restriction.
In terms of hardware, the fire alarm systems taken into account has a TTL/RS232 comunication protocol that allow the local configuration. In order to provide remote access an RS232 to TCP/IP interface has been added to the actual hardware. This component was the XPORT Direct+ from Lantronix. Thanks to this component the system is able to be connected to an IP network (LAN). The network configuration can be done by a web connection or using a serial terminal. The defalut configuration has to take into account the host IP address where the Alarms and Events Reception System is hosted. This configuration has to be done in all fire alarm systems in order to provide information to the Alarms and Events Reception System.
The Alarms and Events Reception System has been develoed using LabVIEW 8.5, figure 3, and is able to manage different TCP/IP connections from different fire alarms systems at the same time. The applications had implemented the original fire alarms systems' protocol. The application registers and monitors all the events in function of the fire alarms systems' model.

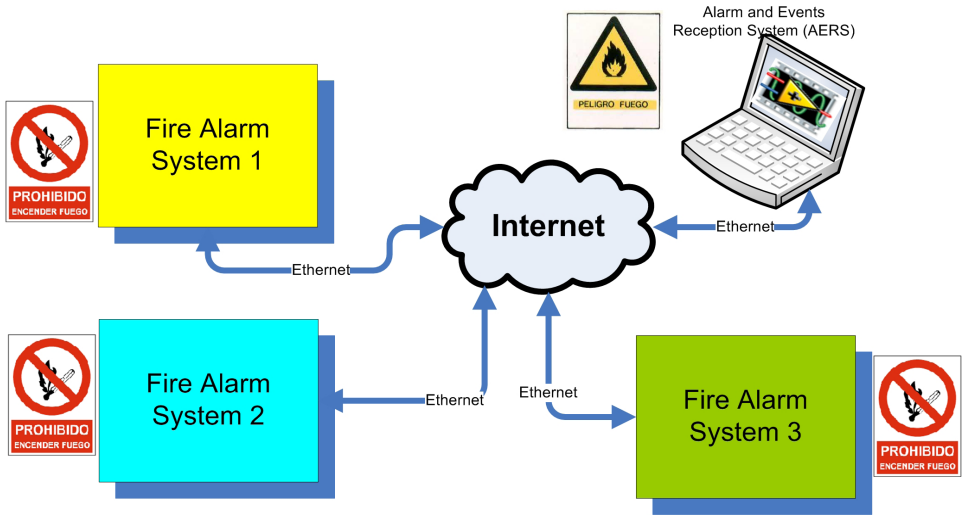

FIGURE 2. Simplified schema

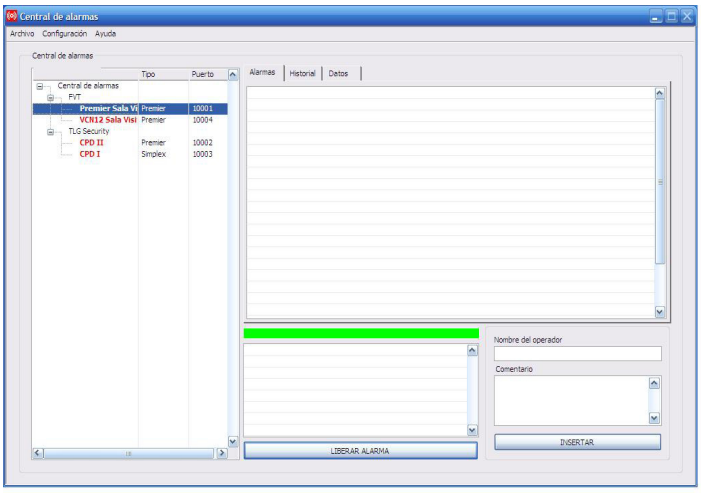

FIGURE 3. LabVIEW Front Panel of the developed Alarms and Events Reception System (AERS)

The most important features of the Alarms and Events Reception System (AERS) are:

1. Subscribe and unsubscribe fire alarm systems.
2. Email alert configuration
3. Event definition for alarm or alert generation
4. Multilanguage defined by the user

The AERS is generating an informative event that is sent periodically by e-mail and is checking continuously the properly function of the fire alarm system and its communications in order to detect hardware or communications failures.

Market Innovation

This Project wants to supply the necessity of the small companies to avoid the use of intrusion alarms in parallel with the fire alarm systems. In case the fire alarm system is able to be monitored remotely can be use as an intrusion detection system.

Another key point of the project was the unique identification of the fire alarm system. Due to no hardware or firmware modifications are possible in the fire alarm device, all of them are fully equal, and the communication protocol doesn't take into account any identification command.

For that reason, in addition to the XPORT device that provided TCP/IP communication a secondary small Renesas microcontroller was installed between the XPORT and the primary fire alarm hardware. This secondary microcontroller works totally transparent except for a known identification command. In order to indentify each device, the MAC address will be used as a unique address. The secondary microcontroller, each time the system starts, ask the XPORT device for his MAC address. When a identification command is received, the secondary microcontroller answer with the MAC address, and this data doesn't affect the normal behavior of the fire alarm device.

The schema is shown in figure 4.

Embedded JAVA Web Server

The XPORT device is able to allocate a web server with a small memory space to deploy a web page. A JAVA application has been developed using applet technologies to provide a remote interface to the fire alarm device. One of the challenges was the reduce amount of memory available for the web page allocation.

The JAVA application works as a TCP/IP server, and implements the fire alarm protocol in order to interrogate and then visualize the state of the system via a web page. The web page is able to configure remotely the fire alarm configuration.

Conclusions

The development of a new Alarms and Events Reception System (AERS) using LabVIEW has been presented. The development time was reduced thanks to the high level API functionality integrated in LabVIEW.

Thanks to the archive and log of alarms and events, system failures can be detected easily. The AERS design provides scalability in case more fire alarm models and their protocols has to be added. The additional hardware has being designed to be added to the fire alarm device, avoiding any firmware or hardware modification to the equipment. This capability enables the system with a plug&work functionality, avoiding manual or remote address configurations.

Finally, the embedded web page inside the fire alarm system provide direct remote monitoring and configuration of the fire alarm system using any internet browser.

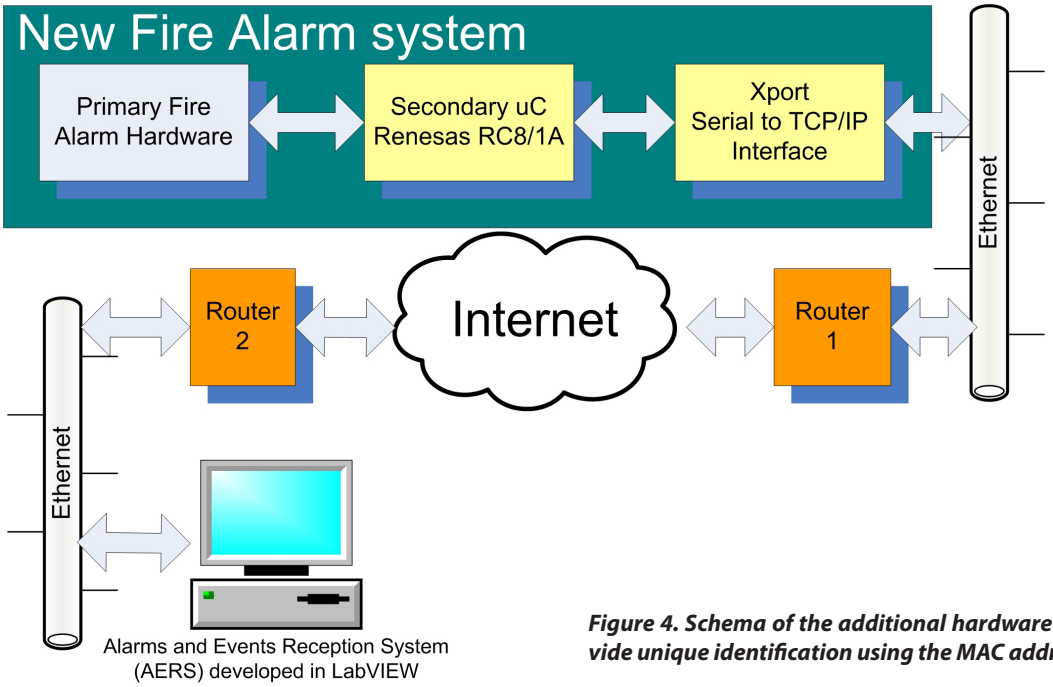

Figure 4. Schema of the additional hardware to provide unique identification using the MAC address.