

Web-monitoring module for the Xilema Suria video surveillance system

Denis Luis Espinosa Pérez¹, Eliecer Sánchez Ramírez², Julio Jesús García Coste³, Yunior Camilo Cabrera Domínguez⁴

^{1,2,3,4} Universidad de las Ciencias Informáticas Km 2½ Autopista La Habana - San Antonio de los Baños, La Habana, Cuba.

Email: dlespinosa@uci.cu, eliecersr@uci.cu, jjcoste@uci.cu, yuniorcd@uci.cu

Received: November 24th, 2017.

ABSTRACT

Accepted: November 24th, 2017.

Published: December 13th, 2017.

Copyright ©2016 by authors and Institute of Technology Galileo of Amazon (ITEGAM). This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Xilema Suria is a video surveillance system, which allows the monitoring, analysis and control of video surveillance IP cameras. It was designed as a modular system that allows the integration of different components and it is developed to be used in desktop environments. This kind of design restricts its use to the monitoring seasons where the visor module is installed. Moreover it decreases its availability and accessibility from other network points. The current paper describes a solution alternative to the problems mentioned before starting from the implementation of a web application for the monitoring, analysis of the video flows emitted by the IP cameras as well as the control of these ones by means of the use of a plugin architecture-based. To develop the application the JavaScript Ext JS framework 4.2.7, the PHP 5.4 programming language as well as the VLC web plugin for its visualization was used. A camera control plugin to the Vivotek PT 7135 was developed by creating the bases for the development of new plugins for the control of other camera modules.

Keywords: cameras, monitoring, video surveillance, web.

I. INTRODUCTION

Nowadays, the video surveillance is a rational solution to security problems faced by the society. The possibility of having lots of cameras connected to each other with functions from the facial recognition and monitoring, video recordings or making real-time visualizing until duties monitoring, acts of violence, people and plates identification, malls and schools surveillance are important advantages that could be obtained as a result of video surveillance systems.

Those systems have as a main purpose, to visualize the video flows from IP cameras in real time, getting the security personal in charge of taking appropriate decisions in case of any problem. This process is known as monitoring in the video surveillance field. Systems are generally installed in a monitoring station which is a hardware location located in a fixed localization in the installation posted to this action previously [1].

Searching in the video surveillance software development has started in Cuba at Geoinformatic and Digital signals Center, which belongs to school 6 from the Informatics Sciences University, the Xilema Suria product is developed. This video surveillance system offers functionalities for the video and flows management processing emitted by a set of installed cameras. The system is composed of the following modules:

- Recorder, in charge of recording the video flows emitted by the cameras connected to the system.

- Returner, in charge of visualizing the video flows saved by the recorder.
- Analysis, to run different video sensors over the video flows.
- Autonomy, with the function of orchestrate the processes occurred in the system as well as the communication among the different modules.
- Visor, in charge of visualizing the flows from the IP cameras, to serve as an interface for the functionalities that offer the other modules. The system has a plugins1-based architecture, which allows the use of a wide IP video surveillance camera models. To visualize the video flows emitted by the video surveillance IP cameras using the Xilema Suria system, is necessary to install the Visor module in a monitoring station. Its installing process can be an annoying task for users with a little knowledge about this theme because of the need to know a set of setting parameters and make a set of steps in order to the product works efficiently. Besides, the designed monitoring station should have enough storage space for the Visor module installation and all its dependencies, making the use of light customers and mobile devices impossible. As a result, in case of being necessary the use of the module from another network terminal, the installation process will make again itself as long as it has the necessary hardware requirements. All this brings as a result that the Xilema Suria system has availability problems, which affects the accessibility levels seriously from any network terminal to its functionalities. From this appropriate evidence on, to develop a

monitoring web module for the video surveillance Xilema Suria was decided.

II. MATERIALS AND METHODS

The monitoring module has the following functionalities: to manage the manager setting, to authenticate the user, to handle the camera, to establish static visualization mode, to establish personalized visualization mode, to manage functions of a video flow, to show visualizer independently, to check connection with the manager and close session.

The customer stations should use Mozilla Firefox version 28.0 as a web browser, Google Chrome 32.0, Opera 20.0, Safari 5.1 or any higher version to access to the system. The VLC Web Plugin in its version 2.0 must be installed. The applications server where the web-monitoring module will be placed should have Apache in its version 2.22 or higher and Hypertext Pre-Processor (PHP) 5.3.8.

In order to have a better system comprehension is necessary that the conceptual framework to be presented, the monitoring by using the web visor module in the Xilema Suria System. The classes, which compose the diagram from the figure 1, are described below.

- User: person in charge of working with the Visor module.

- Visor: Module from the Xilema Suria system, which allows the visualization of the video flows emitted by Internet Protocol (IP) cameras. It interacts with the Manager Module, too.

- Video flows: continuous video sequence, which is emitted by an IP camera.

- Camera: device for the video flows emission.

- Manager: Module from the Xilema Suria system in charge of orchestrating the processes.

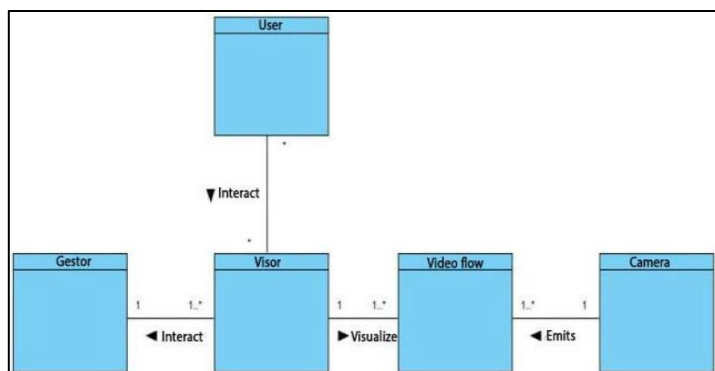


Figure 1: Domain model.
Source: Authors, (2017).

A user starts the monitoring process, which uses the web monitoring module. It is installed in a monitoring station, which should be connected in a local area in order for the video flows process to be carried out. From this module the video flows emitted by several cameras can be visualized and handled. It interacts with a Manager Module, which is in charge of orchestrating the processes of the Xilema Suria system.

For the construction of the system was used the Rational Unified Process (RUP) methodology taking into consideration that it generates a series of artifacts that will facilitate the work of implementation [2]. Another important factor to consider for the choice is the need for the integration of the proposed solution documentation with the Xilema Suria system, in which this methodology is used. The making of the application is based on the use of free tools. According to the above approach is decided to use as client side languages: HTML (Hyper Text Marked

Language) 5, JavaScript and ExtJS 4.2.7, whereas the server-sides are PHP 5.3.8 and PHP NuSOAP library for the communication with the rest of the system modules. VideoLAN Client (VLC) Web Plugin 2.0 is used for displaying video streams.

Then the above technologies are described.

- HTML 5: HTML, is the language in which web pages are written. It lets you type text in a structured way and consists of tags that mark the beginning and the end of each element of the document [3].

- JavaScript: It is an interpreted programming language. It is mainly used because the framework is developed with JavaScript [4]. It is not about an object-oriented language, it is based on prototypes because of the new classes are generated by cloning the base classes (prototypes) and by extending its functionality [5].

- ExtJS 4.2.7: is a framework that allows developing applications with a high level of complexity, based on the use of predefined components in the framework. They have a high degree of configuration and adaptability to the required needs and that is possible to adapt thanks to handle designs having [6]. It also allows the development of applications using the Model View Controller (MVC) architecture.

- PHP 5.3.8: it is a programming language interpreted by a web server that executes the statements without compiling. It is widely used worldwide in the development of dynamic web applications. Their sentences are incorporated within the HTML code [7]. It's characterized according to its power, robustness and modularity. Programs are integrated inside the HTML code directly [8].

- NuSOAP: is a PHP library that allows the creation and consumption of web services based on SOAP (Simple Object Access Protocol) 1.1, WSDL (Web Service Description Language) 1.1 and HTTP (Hyper Text Transfer Protocol) 1.0 / 1.1 [9].

- VLC Web Plugin 2.0: dissimilar allows playback of multimedia formats, offers advantages for working with audio and video streams through the network, with support for a wide range of protocols [10]. The demand for resources during the operation is low. It allows playback of video streams using the RTSP (Real Time Streaming Protocol) protocol, which is the standard for IP video surveillance cameras.

The style of software architecture used was the MVC because of it separates the application source code into three groups: Model, View and Controller. The model will be responsible for communicating with the data and business logic, and the controller will be responsible for receiving input events from the view [11].

A. Advantages of the surveillance video Systems developed with web technologies.

With the growing inclination towards web technologies, according to the advantages and the importance that the Net has taken for people, the video surveillance applications have begun to migrate to this environment [12]. The benefits of web technologies in video surveillance systems make them more competitive in the market for this type of software worldwide [13]. The video surveillance systems on the web incorporate the following benefits:

- The user can easily access to these applications using a web browser.

- It allows the access anytime, from somewhere in the world where a network connection is had where the system to be installed.

- You can update and keep a single application and all users will see the results immediately. Users do not have to update it.
- Technologies that enable portability between different platforms are used. Compatibility problems are reduced.
- A little or no disk space is required. They can be accessed from network terminals diskless or with a very low storage space.

B. Visualization on the Web of the video flows emitted by IP cameras.

IP cameras can emit video and audio flows. They are accessible through URL (Universal Resource Locator) addresses created by the software that controls the camera. It is generally required the authentication to access them and they are emitted in formats, which do not generate a relevant traffic on the Net. There are several technologies on the Web for the visualization of video flows coming from IP cameras or from others sources such as multimedia servers. Besides, it provides several solutions for the visualization and managing of the audiovisual contents. One of these tools is the VLC Web Plugin, which is a complement installed in the browsers for the multimedia contents reproduction. It is capable to reproduce video flows, which use the protocols generally used by the IP cameras for transmission, such as RSTP and HTTP and the handling of the audio and video characteristics. In the other hand, HTML 5 has a video element for the multimedia reproduction on the Web. It is highly settable and adaptable to different contexts. Moreover, it allows the video flows reproduction by using the HTTP protocol, but nowadays, it is not capable to reproduce flows that use the RSTP protocol.

C. Handling of IP cameras setting parameters from the Web

IP cameras provide a series of settings, which allow the personalization for different contexts, according to the willing and functions they have. Such settings are accessed and modified by the software that controls them or outside systems through different parameters.

The parameters are in charge of providing information about the camera such as: model, name, IP address, or modifying their specifications such as: images fit, audio, video characteristics and others specifications. The access to such parameters is generally made by mean of a URL defined by the manufacturer. Because of this, the way to access and modify the parameters of an IP camera changes, so that each camera model should be treated in a unique way.

III. RESULTS AND DISCUSSION

In the deployment diagram the physic disposition of the different elements are shown. They are known as nodes, which take part in the process and the existing relationships among them [14]. Making the graphic of the physic environment where the video process is developed, different key issues can be understood like the system distribution, which influence directly in the implementation. The nodes that compose the deployment diagram are described below.

Monitoring station: net terminal from which a user makes use of the web-monitoring module by means of a browser. Web server: server where the web-monitoring module will be placed. Camera: device in charge of emitting video flows. Applications server: server where the Xilema Suria system Manager module will be placed.

The access to the web-monitoring module happens from a monitoring station. It is placed in a web server and establish the connection with the Manager module, which is available in an application server. Both connection security, are ensured by using the HTTPS (Hyper Text Transfer Protocol Security) protocol. In the web-monitoring module, the video flows emitted by the integrated cameras can be visualized and the ones which have an associated plugins can be controlled. For this process, the RTSP and HTTP protocols are used. The deployment diagram proposed for the web-monitoring module is presented below.

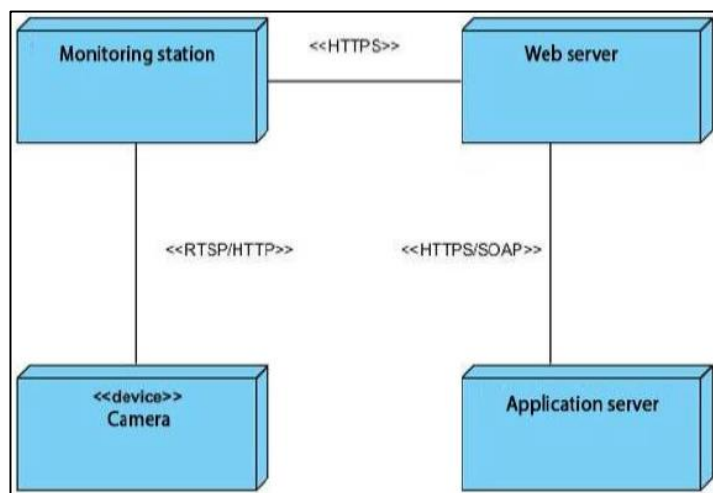


Figure 2.: Deployment Diagram. Source: Authors, (2017).

To use the Visor module is necessary first to set the connection parameters with the Manager module. Once having tested and stored properly the Manager module setting, the user can authenticate and access to the system. In the figure 3, the start interface of the web Visor module is shown.

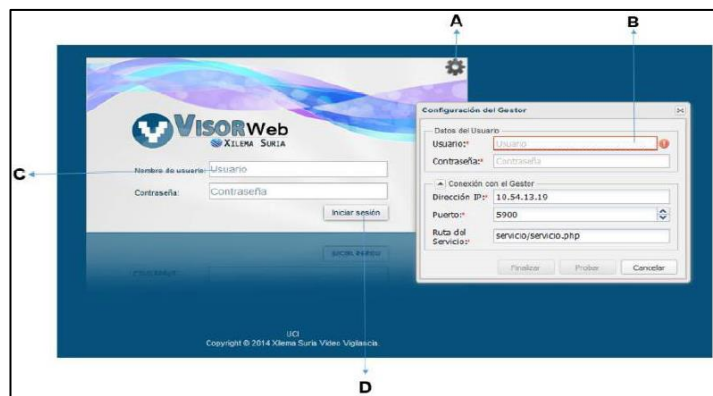


Figure 3: Start interface of the web Visor module. Source: Authors, (2017).

Description per areas of the start interface of the Xilema Suria system web Visor module

A) Manager setting: it allows accessing to the setting form of the connection parameters with the Xilema Suria system Manager module.

B) Manager setting: it allows setting the connection with the Manager module, testing and storing the setting parameters.

C) Authentication form: it allows the user to introduce the authentication data.

D) Session starting: A button that allows the user start the session in the web Visor module.

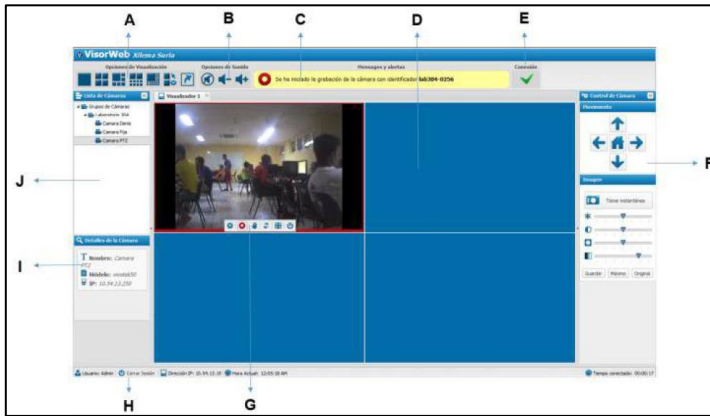


Figure 4: User graphic interface of the Xilema Suria system web Visor module.

Source: Authors, (2017).

Description per areas of the start interface of the Xilema Suria system web Visor module.

A) Visualization options: it allows the user to choose a static visualization mode. In the area, the options that allow using the personalized modes designer and the one to show the visualization mode independently are also found.

B) Sound options: area that allows the volume control of the cameras that are visualizing themselves in that moment.

C) Messages and alerts: in this area the system notifications are shown to the user.

D) Visualization panel: an area where the different visualization modes chosen by the user are loaded.

E) Connection: the connection state with the Xilema Suria system Manager module is shown.

F) Camera control: in this area, the corresponding plugin to the camera model wanted to control is shown to the user. The visual interfaces are built by each camera plugin specifically and they change according to functionalities the camera has.

G) Operations menu: it allows managing the functions of any video flow. From it, starting the recording tasks, movement recognition, controlling IP cameras, recharging video flows, maximizing the camera views and closing the visualizations could be ordered.

H) Information panel: it provides useful information to the user as for example: the current time, the time stayed authenticated in the system and the IP address from which they have been accessing to the web Visor module. In this area, "The Closed session" option is located.

I) Details: the corresponding information to the chosen camera is shown: name, model, IP address, and others. It also shows extra information corresponding to the camera groups and to the system.

J) Cameras list: It shows the cameras list available in the system. They can be visualized when dragging them and letting them go of one of the visualizing divisions.

IV. CONCLUSIONS

The solution proposal is new according to the use of web technologies working as a complement to the traditional video surveillance software. A plugin-based architecture allows the system will be able to handle lots of models of IP video surveillance cameras, which make feasible its use in some environments where with different kinds of cameras could be counted. The use of the ExtJS framework provides an easy interface to handle by the system operators and its latency times are too significant for emplacements of less than 12 cameras.

With the introducing of the web-monitoring module, the Xilema Suria system decreased its scalability and availability problems. The aggregate value of the system increased when adding it new possibilities of IP video surveillance cameras control and possibilities from others net terminals. The use of computational resources from client side allowed a better hardware use of the monitoring stations.

V. REFERENCIAS

[1] Collins, Robert T. y Lipton, Alan J. **A system for video surveillance**. Pittsburgh : s.n., 1999.

[2] González Ibgargolín, Neyver. **Intitutional Repository**. Habana : s.n., 2012.

[3] Frain, Ben . **Responsive web design with HTML 5 and CSS**. London : s.n., 2012. 978-84969-318-9.

[4] Guzmán Fernández, Ismary, Castillo Figueroa, Reinier y Flores Pérez, Dayani. **Proposed architecture of a web tool for PostgreSQL administration.**, Havana : Future Editions, 2011, Vol. 5. 1994-1536.

[5] Flanagan, David. **JavaScript. The definitive guide**. Madrid : Anaya Multimedia, 2007. 978-84-415-2202-2 84- 415-2202-2.

[6] Acosta Ortiz, Luis Ernesto y Sánchez Delgado, Daylenis., **Computer system to manage the entrance plans to Middle and Higher Education in Cuba**. Havana : Future Editions, 2012, Vol. 6. 2227-1899.

[7] **PHP. PHP. [En línea] 2013**. [Citado el: 24 de January de 2014.] <http://php.net/manual/es/intro-what-is.php>.

[8] **PHP and MySQL. Technologies for the web applications development**. Cobo, Angel. 2005. 84-7978-706-6.

[9] **W3C Recommendation. W3C. [En línea] 27 de April de 2007**. [Citado el: 4 de December de 2013.] [http://www.w3.org/TR/2007/REC-soap12-part0-0070427/..](http://www.w3.org/TR/2007/REC-soap12-part0-0070427/)

[10] **VideoLAN. [En línea] 2013**. [Citado el: 15 de May de 2013.] <http://www.videolan.org/videolan>.

[11] Potencier, Fabian y Zaninotto, François. **Synfony 2**. 2012.

[12] Mora Luján, Sergio. **Web applications programming: history, basic principles and web clients**. s.l. : Universitaru Club, 2010. 978-84-8454-206-3.

[13] Tejada Pizarro, Alexis Manuel. **Construction of a video susveillance web system for laboratories from D.I.S.C by means of IP cameras**. Antofagasta : s.n., 2010.

[14] Booch, Grady, Rumbaugh, Jim y Jacobson, Ivar. **UML: the Unified Model Language**.