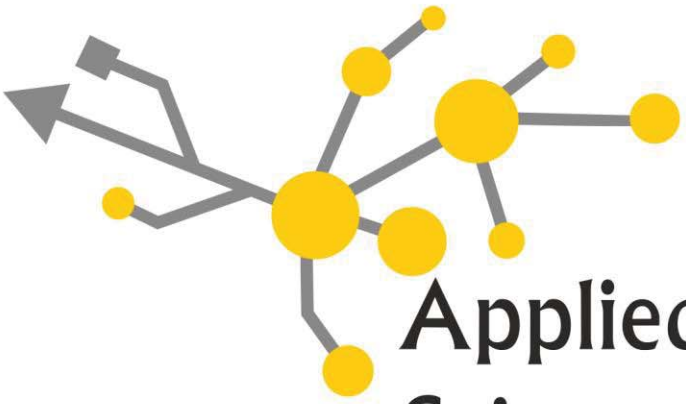

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ABSTRACTS BOOK

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ABSTRACTS

BOOK

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Computer-based monitoring platform for renewable energy systems: Four experimental application cases using NI LabVIEW

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1. Introduction – During last decades, the global energetic scenario is evolving towards a scheme with increasing relevance of Renewable Energy Sources (RES) like photovoltaic, wind, biomass and hydrogen. A management and control strategy is responsible of providing reliable, stable and efficient operation. To implement such strategy, a monitoring system is required. Computer-based monitoring platform is in charge of acquiring the system operative data and processing them. Real-time information is continuously provided to the supervisor via an interactive and graphical interface; data storage is also performed. Diverse scientific literature points out the relevance of monitoring platforms for RES systems [1,2]. The National Instruments (NI) LabVIEW package is general purpose software for instrumentation and control that provides an easy-to-use graphical environment and powerful built-in functions. It has been previously used to monitor this kind of systems [3-5]. The present work aims to contribute to experimentally validate LabVIEW as valuable tool to develop monitoring platforms in the field of RES-based facilities. To this aim, a set of real systems successfully monitored is exposed.

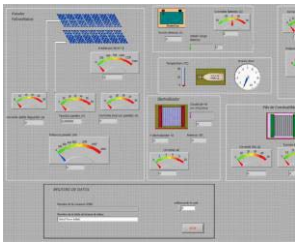

Image 1. Monitoring screen

2. Results and Discussion - The monitoring platforms of four RES-based plants are exposed. The first one is a Polymer Exchange Membrane Fuel Cell (PEMFC) stack. An autonomous hybrid wind-solar system including equipment for hydrogen generation, consumption and storage is the second experience (Image 1). A hybrid wind-solar park comprising different photovoltaic technologies (amorphous, monocrystalline, polycrystalline, polycrystalline with solar tracking) is thirdly described. The last case is a plate photobioreactor for microalgae culture devoted to biomass production. LabVIEW is used in all of them to directly monitor the process or to acquire and exchange data. Ole for Process Control (OPC) protocol has been included in the last two facilities to exchange data

Table I. LabVIEW role summary.

System	**LabVIEW role**
PEMFC	Monitoring
Hybrid system with hydrogen	Monitoring & Control
Hybrid system of different PV modules	Data exchange for Monitoring
Biomass photobioreactor	Monitoring & Control

between the field devices and the monitoring software. The PEMFC tracking software is nowadays under improvement. All the others systems have been working during almost two years, demonstrating the reliability of the developed platforms. Table I summarizes the role played by the LabVIEW program in every case.

3. Conclusions - Four experimental RES-based plants under real working conditions have been exposed. The validation of LabVIEW software as valuable tool to develop effective monitoring platforms for RES-based facilities has been carried out. The ability of this program to handle the different devices and protocols involved in the facilities has been proved.

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SCADA software for education in automation and supervision: Initial evaluation of Easy Java Simulations

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1. Introduction – Supervisory Control and Data Acquisition (SCADA) systems constitute a fundamental issue in the automation and control engineering education. In the Systems Engineering and Automation area of the University of Extremadura, the software Siemens WinCC and National Instruments (NI) LabVIEW have been traditionally used in automation and supervision courses. In this work, a novel proposal is presented: using Easy Java Simulations (EJS) as SCADA educational tool. EJS is an open source tool based on Java devoted to create discrete simulations and virtual and remote laboratories [1]. It is continuously updated and improved by means of modules that enhance its capabilities.

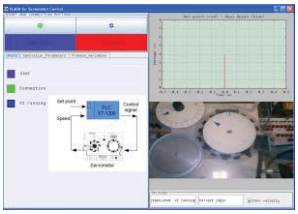

Image 1. Main screen of the developed

This article reports the initial evaluation of EJS as educational SCADA software. To this aim, a SCADA system is developed to monitor and control an experimental plant by means of an interactive Graphical User Interface (GUI), as can be seen in Image 1. In addition, in order to acquire operative data, an Object-linking embedded for Process Control (OPC) link has been created.

2. Experimental – A servomotor controlled by a programmable logic controller (PLC) serves as plant to be supervised. To connect the EJS-based GUI with the field device, intermediate software is required. Specifically, a LabVIEW program has been designed and applied to this purpose. EJS Java-Internet-LabVIEW (JIL) server enables the information exchange between EJS and LabVIEW. On the other side, LabVIEW accesses the PLC data by means of an OPC interface. I.e., the OPC server accesses the field device signals and makes them available for the LabVIEW client. The NI LabVIEW and OPC Servers version 2013 have been used. The EJS version was released in September 2015. Regarding the physical connections, the PLC is linked to the PC where the software runs through Ethernet.

3. Results and Discussion – The developed EJS-based SCADA effectively monitors and control the plant. In fact, EJS manages essentially the same concepts than other SCADA-devoted packages, namely: fields for read/write operations, graphics for variables evolution, code definition for advanced operations, animation of drawing elements illustrating the process, and so on. Some advantages of EJS to note are now commented. It is a free software; integration

with video from camera is very easy; it includes a tool (Data Tool) to manage the data; a high grade of interactivity is provided. On the opposite, there are also some disadvantages namely: developing synoptic is not easy; data storage must be performed by the user by means of such Data Tool; the connectivity options are bounded so it requires the intervention of intermediate software (LabVIEW in the studied case).

4. Conclusions –The main contribution of this work is the initial evaluation of EJS as educational instrument in the context of SCADA systems. The novelty of this proposal relies in the usage of a software package devoted to create simulations and virtual/remote laboratories as tool to teach supervision and monitoring. Communication between EJS and industrial field devices as PLC is provided by LabVIEW and OPC technology. Supervision of a real experimental system has been carried out. Further application and assessment is under development. Authors consider that EJS may serve as complementary software tool for teaching SCADA development.

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