Educational Scenarios Using Remote Laboratory VISIR for Electrical/Electronic Experimentation

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Abstract. In 2015, Electrical and Computer Engineering Department (DIEEC) of the Spanish University for Distance Education (UNED) in Spain started together with the Santiago del Rosario National University (UNSE, Argentina) and with the support of the Research Institute of Education Sciences of Rosario (IRICE-CONICET, Argentina) under the Coordination of the Polytechnic Institute of Porto (IPP, Portugal) the new development and deployment of the VISIR system inside the UNSE University as part of the VISIR+ Project.
The main objective of the VISIR+ Project is to extend the current VISIR network in South America, mainly in Argentina and Brazil, with the support and patronage of the European Union Erasmus Plus program inside the Capacity Building program and as part of an excellence network future development integration framework. This extension of VISIR nodes reconfigure in 2016 a new project, PILAR, that as part of the Erasmus Plus projects will allow the Strategic Partnership to develop a new federation umbrella over the existing nodes and network.

Keywords: Remote laboratory, VISIR, Educational scenarios.

1 CONTEXT

Experimentation has been always a pillar in which educational institutions trust to narrow the gap between academic and industrial worlds. The experimentation allows students the interaction with real components, equipment and instruments, the verifi-

cation of the theoretical laws governing the behavior of electric and electronic circuits or the analysis of non-desired effects such as noise on output signals, temperature effects on components, behavior of different component technologies, etc. Unfortunately, laboratory resources are limited because of their availability, costs, etc. This limitation induces in students a path to address practical experiences separately from theoretical contents, just if they were two activities non related one to the other.

2 ORIENTATIONS ON THE WORK

The emergence of remote laboratories has provided new horizons in the learning process and has brought new challenges in teaching design. Remote laboratories are being used in many different ways and with different strategies as in-person laboratories have been used traditionally.

Remote laboratories are a new tool to complement in-person laboratory, simulators and virtual laboratories. The pool resulting by all the available possibilities provides a wide range of possibilities when designing a course in which experimentation plays a key role.

Virtual Instruments System In Reality (VISIR) is a remote lab for wiring electric and electronic circuits experiments that has been used, in the Electrical and Computer Engineering Department (DIEEC) of the Spanish University for Distance Education (UNED), within several subjects from different engineering degrees, master subjects, expertise courses, Small Private Online Courses (SPOCs) and Massive Online Open Courses (MOOCs); providing satisfactory results with regarding to either it's performance or skills acquired by students.

The whole system, formed by all the actors and all the strategies used in the diverse scenarios, have been analyzed in order to define a new learning environment, with the objective of achieving an improved system in which all the teaching/learning scenarios must have room, solving the inconveniences experimented separately and in their interaction between them.

3 APPROACH USED

The main advantage of remote laboratories versus in-person laboratories lies in its access availability without temporal nor geographical restrictions; The main advantage of VISIR, when comparing with other electronic remote laboratories, lies in his concurrent access: multiple users interacting with the remote laboratory simultaneously, designing the same or different circuits and monitoring the same or different signals in real time, as in an in-person laboratory room with replicated workbenches.

The experience reached in the integration of remote laboratory VISIR, mainly in distance education, and the data collected from students' feedback, logs related with the remote laboratory interaction, surveys, etc. have allowed identifying the needs for improvement and/or redesign.

All the data gathered from the LMS (Learning Management System) platforms have been obtained analyzing the different databases ((PostgreSQL, MongoDB). To

evaluate VISIR behavior (accurately of the measurements, response managing requests' overload, etc.) and to inspect students' interaction in the laboratory (common mistakes typical from VISIR, number of accesses, etc., its database (MySQL).

VISIR, (number of accesses, etc.) has been analyzed its database (MySQL) and its logs (over 51 million of lines from the logs).

Inside the VISIR+ and PILAR projects, as well as previously inside the use of the remote laboratory VISIR in the distance and online learning courses at UNED and the MOOCs delivered using the VISIR system, a wide use has been obtained and published regarding this use, [1-9].

According to Ursutiu et al. [10] and its reference to Learning by Experience from Haynes any experience for learning involves a number of steps:

- Experiencing / doing with the instructor`s help or not;
- Sharing / what happened?
- Processing / analyzing;
- Generalizing;
- Applying.

Using this experience, the process developed to be more effective inside the new starting of new installations, [11-16], (hardware, software and educational uses inside the High Educational Academic environments) sites with the VISIR remote laboratory and software are:

1. Share publications and tutorials regarding the use of VISIR inside electrical and electronics engineering courses.
2. Share the use of VISIR remotely to allow the new teachers access to start working with the VISIR system.
3. Start a first time face-to-face experience with some of the decision making teachers and academic administrators regarding the feasibility and best practice of the use of VISIR inside the target institution.
4. Start several synchronous sessions (using some collaborative environment, like Moodle, videoconference facilities, etc.) with the new teachers and personnel involved in the new deployment to allow a fast starting access as well as the first touch of the system. During these preliminary sessions the expert or monitor will show the main functions and specifications of the VISIR system as well as some starting simple examples and use in the same environments and working area of the future implementations.
5. Develop the face-to-face delivery with all the people involved in the on-site implementation as well as with some possible new target institution members in the area of the local University to try to have a core users target that will have in the future the local use.
6. Have a local experience on the use and development of the educational implementation of the VISIR remote examples with the local students, inside the classroom and as well as with remote access to extend the experience of the use and as complementary use of the remote laboratory.

7. Develop and extend the teaching experience from the local institution to all the core new institutions inside the local area to reinforce the knowledge and implementation as well as to develop new local strategies and synergies.
8. Realize a formal evaluation and quality assurance of all the process involved during the implementation of the previous new acquisition and development of the VISIR remote laboratory deployment.

4 OUTCOMES

The integration of remote laboratories in online learning environments, together with good practices in designing practical experiences, can alleviate the disadvantages of remote laboratories compared to in-person laboratories, without leaving behind their inherent advantages. What's more, the strategy of using diverse and complementary options in the same course (as in-person laboratories, remote laboratories and/or simulators) provides a broad range of capabilities and an easier assimilation of the experimental advantages in the academic domain, [17-19].

Students have been able to complete the different activities and tasks from different courses and educative platforms, to interact with the remote lab, etc. So, for students, the different systems used have accomplished its function: to provide the remote laboratory along with theoretical contents.

Previous experience for the UNED system implementation, communities and platform, aLF and INTECA videoconference system, allow the implementation of the remote laboratories as well as the support systems inside UNED Abierta, [20-24],

However, for teaching staffs it has been no possible to track the students' interaction over the different actors, so it has not been possible to cross the information obtained from them. A new whole system, taking into account all the inconveniences and difficulties found, has been developed and is being deployed for the opening academic year, [25-32].

5 CONCLUSIONS

The results show the ductility of VISIR remote laboratory in different learning scenarios. Together with VISIR, it is needed a well-designed course, contents and experimental experiences in order to obtain satisfactory results since, not only VISIR, a remote laboratory is a tool: it is a means, not an end in itself.

A LMS platform with the necessary tools for a deeper analysis of the students' learning process and that integrates both environments (courses' platforms and remote laboratory) seems necessary in order to evaluate the convenience of the supplementary documentation (videos, documents, activities, etc.) and their relationship with learning and disengaging.

All these findings led to a new and more inclusive structure for the whole system in order to a better exploiting of the experimental resources and, mainly, to create a new learning environment intended for the analysis of the learning process for further improvements.

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