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Optimization Of A Remote Lab And E-Learning Platform

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Abstract – The incorporation of remote lab into educational system will play a vital role to problem solving towards enhancing quality learning. The proposed system encourages students to follow remotely courses and practical works. With this solution of the remote system, students can manipulate hard laboratory equipment. The insurance quality for this education system becomes a necessity especially online practical works. This paper develop a tool that enable us to have a detailed report about the student and teacher's satisfaction concerning online practical works remotely. The remote-lab exploit questionnaires to generate reports that will enable decisions for the enhancement of infrastructures and also increased student access to equipment, a wider range of possible assignments or activities, and enhanced opportunities for collaboration among students. This system brings hope for reducing costs and improving control education quality.

Keywords – *eLearning, quality insurance,* remote laboratory; distance education.

I. INTRODUCTION

The development of the ICT on the world accommodates researcher to idea and understand a remote-lab system (RL). Before COVID19, the RL has been created to make the thoroughly move from the learning face-to - face to e-learning. But, these days, the RL solution became a necessity for education. The e-learning framework it's the better answer for address the episode brought about by the pandemic. Multiple solutions and structures are created to understand the RL framework in the writing. Somewhat recently, different distant lab have been made and tried with progress. The RL empowers the universities to guarantee both course and viable work utilizing e-learning framework. Each foundation can distantly utilize the materials for piratical works that is mounted in the college to works with the upkeep and improve security. The quality protection it's an extremely intrigued measure, this movement should be to start with, during and after each online academic action (courses, pragmatic work). Lorenzo has fixed the five mainstays of value in the online training that incorporate learning viability, understudy fulfillment, personnel fulfillment, cost adequacy and access [1]. In our paper we center on the quality protection of the utilization of RL in the e-learning framework. Truth be told, we

guarantee the fulfillment of the RL clients like understudies and instructors to improve our framework and the pragmatic work situations.

II. REMOTE-LAB SYSTEM

The remote laboratories can be safeguarded by two techniques remotely simulator and remotely hardware manipulation in real time. Remotely hardware laboratory enables student to remotely use and control the laboratory equipment's and has the same benefits of someone inside the laboratory.

The RL present multiple advantages such as; enable university to provides a full online degree, let the person that has the specific need to do at home as well as their practice work, provide a solution for university to stay active in the major force that induce the outbreak like COVID… The principal actor of RL are students and teachers. Our RL application enable students to connect with their connection parameter's to remotely do their practice work. For the same students can submitted results and interpretations to their teachers. The teacher has a most important roles in our system. The teachers prepares the necessary materials for the remote practice work like the needed equipment's. This remote lab doesn't provide the possibility to be used by multiple students at the same time. To solve this constraint, each registered student must reserve in advance the time of their practice work. Student can access to RL everywhere and in the reserved time, the laboratory is operational 24 hours. The students are able to manipulate the hard lab equipment's and do their work directly with the real equipment's. The webcam installed in the laboratory enable students to see in real time the lab equipment's and can remotely interact and interpret the results. The lab equipment's must provide the possibility to be manipulated by Laptop or by any other module that contain an operator system like raspberry Pi. The switched module enable the users to choose the practice work and move to another practice work.

Figure 1. A global online and remote laboratory community.

2.1 Review Of Literature

In this section, we survey some of the previous approaches used by researchers for remote lab education by students, teachers and institution's.

As indicated by [2], States that remote lab which targets electrical designing courses at the University of Patras, Greece, and starting in 2004. RMCLab joins a FPGA notwithstanding "helper modules" which incorporate differential speakers, PLLs, ADCs, and OpAmp circuits. The labs are separated to utilize various parts of equipment and circuit plan and examination. The equipment is associated through PCI to a host worker which coordinates a sign generator, oscilloscope, and other uncommon equipment over a custom LPT interface. Expanded customer worker design partitions the ordinary customer engineering into a customer and teacher customer (IC), and the worker engineering into an application worker (AS) and asset worker (RS). RMCLab's hand craft is very explicit to the accessible assets from the University. The individual workers arrange access with approaching customer demands with accessible equipment assets. While such a framework can enhance huge class sizes, one key disadvantage is versatility to other

homeroom conditions where these accurate assets don't exist. In [3], planned a FPGA e-Lab, far off access framework focused for computerized configuration courses utilizing FPGAs dependent on Xilinx's Spartan-3E Starter Kit. The e-Lab utilizes Windows XP Remote Desktop to interface the far off client with the FPGA, information obtaining equipment, and Lab View, Integrated webcam and GPIO to associate LEDs, switches, and control equipment on the real FPGA. An undeniable benefit of such a framework is the low beginning up costs related with procuring the Spartan Starter Kit and programming apparatuses, however the utilization of Windows XP Remote Desktop eases back the framework. As per [4], gave an account of NetLab from the University of South Australia which expects to address the regular worries of far off research centers. With a comparable plan to the past endeavors, NetLab consolidates an assortment of lab hardware and even ventures to such an extreme as to permit joint effort between understudies. The paper presumes that while the far off lab arrangement didn't straightforwardly beat customary genuine labs, the creators propose a blend of genuine and far off labs all through the training educational plan.

In [5], built up a model that examines the general viability of involved labs, distant labs and reenacted labs. The labs led were centered on the kinematics and elements of instruments like linkages, cams and pinion wheels. To draw a reasonable examination, out of the six labs given to the class, three were given in conventional arrangement and three were given in involved customary organization. Notwithstanding the understudy results and understudy fulfillment, understudy inclinations for distant labs were identified with understudy attributes, in reasoning style and capacity. The outcomes got by Corter et al show that among different standards like preliminary directions, lab report, and collaboration, "actual presence in the lab" was evaluated least significant by the understudies. Additionally, real learning results were evaluated by inquiries on the midterm and last that was identified with the substance of the labs.

As per [6], surveys that virtual lab intends to accomplish adaptability in advanced and simple circuit configuration remembering the expense, versatility and seclusion. A FPGA board is utilized as it takes into account execution of practically any circuit. Here, the interface to the distant lab is accomplished by joining Virtual Network Computing (VNC) and secure far off work area. Test suites were built up that are lab tests which can be utilized by understudies. The test suites incorporate an Analog Circuit - a basic circuit is set up which can exhibit the utilization of a force supply, oscilloscope, a switch grid and a capacity generator which can all be controlled Remotely, FPGA Programming - shows that the FPGA can be utilized Remotely by means of the Internet, Digital Signal Processing Experiment - A simple sign is caught then utilizing the ADC interface it is digitized. The sign is then passed to the FPGA utilizing VHDL. This framework likewise gives a webcam so the clients can take a gander at the FPGA board. This framework was assessed and it was found reasonable for college classes.

In [7], executed by the University of Bordeaux in France is an exertion toward expanding Remote schooling for Electrical Engineering. The parts that make up this framework are a pool of instruments that can be controlled distantly, a gathering of workers and committed programming. The computerized circuits executed by this lab incorporate Differential Pair Amplifier, Linear OpAmp activity, and RC channel. Once more, a camera is set in the eLab's room that permits a live perspective on the instruments and workers. The eLab page likewise contains different reading material that are needed for the courses that utilization these labs. The web interface is a basic one that permits clients to set information focuses, recurrence esteems and voltages. The consequences of these information sources can be then estimated in new spring up window which permits clients to save the yield. A fascinating element with regards to this framework is that a "journal" is naturally made that stores the outcomes and estimations of the client.

As indicated by [8], introduced a distant lab for an optical circuit's course. The methodology utilized in this office is to initially acquaint the understudies with the ideas in principle and afterward continue to pre research center exercises. The pre labs incorporate a direction video, reproduction and lab systems on-line. This work likewise incorporates evaluation of the learning results and instructing techniques. Here, the understudies associate with the worker utilizing a Web-based customer that interfaces with the Lab View Web Server. Three investigations were directed; Optical Source Characterization, Optical Fiber Link Attenuation and Fiber Connectors, Hands-On Skills Transferred From Remote Labs, in view of execution of the understudies on these tests, understudy achievement was estimated. An understudy assessment overview was directed as well.

In [9], clarifies the advantages of setting up for remote lab for science utilizing the iLab innovation created by MIT, expresses that an overall lab for science that should be possible distantly, prompts shared expenses, productive utilization of assets and higher work effectiveness. From the above depictions, it very well may be noticed that numerous analysts are examining the adequacy of distant labs in their particular fields. A considerable lot of the labs execute FPGAs because of their adaptability and re-configurability, yet the quantity of distant labs for FPGA schooling is moderately not very many. The objective of this paper is to extend FPGA schooling and other electronic courses dependent on lab packs. Additionally, the utilization of a webcam in this

undertaking is important to make reality to the presence in the lab. Another fascinating truth to note is the assessment strategies utilized in these offices. Since there is no standard technique for demonstrating the adequacy, it very well may be seen that the pattern is to gather input from the understudies utilizing the office. Albeit, narrative information is apparently not the most grounded methods for demonstrating realities, it is exceptionally useful to improve the office. Another technique is to test the understudies and drive learning results. From the normalization perspective, the main distinction of the work portrayed in this paper is that it is relatively more adaptable as in the equipment and programming are both adaptable to fit in various conditions.

III. Structure Of The Remote Laboratory

A remote laboratory must be capable of providing a learning experience that enhances the existing learning experience and provides added value to a study program. In some situations, it can be used to supplement an at-presence laboratory for local students. In other situations, it may provide for access to laboratory equipment and experiments that do not exist within the education institution. However, it should not be considered as a “low cost” replacement of an at-presence laboratory since the role of technology should be to support and enhance the learning experience rather than finding a way to simply reduce costs. Whilst the remote laboratory might initially seem to be a “low-cost” alternative, there is the cost of design, development and maintenance to consider. Hence, each type of laboratory provides for a unique set of advantages and disadvantages. With the remote laboratory, the initial steps to creating a remote laboratory that is both useable and useful involve the identification of the intended uses, the target audience, the technologies to use, and the integration of the laboratory into a program of study. This might involve the integration of the laboratory into a suitable learning management system (LMS) or access to a content management system (CMS). When considering the architecture of the remote laboratory, it is useful to develop the architecture to meet both the current needs and potential future uses. Adopting such an approach would reduce the need for major effort in any future development work. Laboratory must be capable of providing a learning experience that enhances the existing Learning experience and provides added value to a study program. In some situations, it can be used to supplement an at-presence laboratory for local students.

3.1 Access To The Laboratory Equipment

Remote experiments in a distance learning context offer the possibility of access to exciting experimental facilities and the undertaking of particular experiments at the point in the course when they are most relevant to what the students are studying. There are three specific conditions for the arrangement of experimental work remotely readily offered to students [10].

1. When the students are studying at a distance from the institution;
2. When the equipment required for the desired experimental work is considered prohibitively expensive;
3. When it is difficult to cope with large student numbers given the lab space available.

In the first case, distance learning, traditionally experimental work has been offered by simple “home experimenter” kits and intensive residential schools as part of a distance learning course. The home experiment kits obviously have limitations on the range of experimental work that can be undertaken [11]. The private schools can offer admittance to great research center offices yet here the majority of the viable work related with a specific course must be assembled into an escalated week say. Increasingly there are demands on engineering and science courses to give their students experience of state of- the-art laboratory facilities. These demands may come from accrediting bodies or key prospective employers of the students on the course. Now this can be prohibitively expensive especially in the cases where this equipment would only be used for a small part of the year. One solution here offered by the remote experiment approach is the possibility of sharing expensive equipment between different institutions. The third case can be addressed by providing experiments on something like a 24/7 basis remotely over the Internet. In this way, the same physical space can cope with much larger student numbers and a greater flexibility can be offered to the students as to when they undertake their practical work.

IV. Results And Discussion

To test the system, we have addressed our questionnaire for students and teachers. The opinion of these two actors is very important to optimize our practical work and our remote laboratory infrastructure and finally, we install our application (plugins) in our platform and generate the report. This framework contains the important outcomes that empowers the far off lab entertainers to take the best choice to enhance the distant functional work. The improvement of a metric application for our RL, it needs an adaptable device to separate significant information from polls. Initially, we identified the best solution been the use of Moodle

plugin that can be integrated directly to Moodle platform. We proposed a system that is a standalone application developed to create reports based in survey. After answering the questionnaire by trainees, the teacher has to back up the questionnaire, customize the report, and generate the PDF. The system provides for the user an interactive service, also the user can focus his work in one question or question group and the system also enables user to put the necessary information and results in the report.

V. CONCLUSION

In this paper best practices were identified, and data was collected which suggests they can be a viable means to teach experimental procedures to students who do not have access to traditional equipment. It provides motivation for universities to set up Remote Laboratory and also for student and teachers in distances learning. This paper shows the benefits Remote Laboratory implementation can provide for various institutions. The appropriation of Remote Laboratories for research facility classes, Distance Learning and customary learning can give significantly more freedoms to students. Students without the capacity to drive to campus are able to share experimental experiences with other students‟ independent of their locations. There is a greater opportunity for collaboration wherein students complete group work with people from other universities, or even other countries. Universities could possibly offer full degrees which are not presently accessible for students who can just take classes on the web.

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