

# Remotely Activated Virtual Laboratory

## An e-Learning Tool

Mr. Praahas Amin

Dept. of Information Science and Engineering  
Sahyadri College of Engineering and Management  
Mangaluru, India  
*praahas@gmail.com*

Mr. Vasudeva Rao P V

Dept. of Information Science and Engineering  
Sahyadri College of Engineering and Management  
Mangaluru, India  
*vasudeva93@gmail.com*

**Abstract**—Colleges are usually equipped with the laboratory equipment required for the prescribed experiments. However, many theoretical concepts require practical demonstration (with sophisticated equipment) for better understanding. These equipment may not be available in colleges, due to which, teaching faculties face difficulty in demonstrating them. In order to overcome this situation, an attempt has been made to develop a system which provides an interface to the user through which sophisticated equipment situated at a remote location can be easily accessed via any computing device. This work emphasizes on Publisher-Subscriber pattern, Subscriber can be any computing system connected to the internet and the Publisher will be a system with LabVIEW to which the lab equipment will be connected via National Instruments Data Acquisition Module (DAQ). For communication between Publisher and Subscriber, an add-on called Smartphone and Cross-Platform Communication Tool (SCCT) has been used.

**Keywords**-Remote Lab, SCCT, Publisher-Subscriber, LabVIEW

\*\*\*\*\*

### I. INTRODUCTION

In India, e-learning is gaining tremendous importance [1]. The resources from recognized universities across the globe are available to the students online. Keeping this in mind, the MHRD (Ministry of Human Resource Development, Govt. of India), has taken an initiative of getting all laboratories under e-learning facilities, i.e. creation of Remote Laboratories [8, 9]. The ideas of implementing Remote Laboratories are being discussed among some selected set of universities and colleges across India.

Remote Laboratories are the ones, which can be controlled and accessed by the user over a communication channel using a computing device [2]. In order to achieve this, students and faculties should have access to remote equipment. In the proposed work, using Publisher Subscriber technique is used. Publisher and Subscriber are being developed using LabVIEW [3]. Also it is being expected, that Remote Laboratories will improve the quality of engineering education tremendously.

Different technologies, both open-source (PHP, JAVA, JavaScript, AJAX etc.) and proprietary (LabVIEW) are being used for developing Remote Laboratories [4, 5, 6, 7]. The solution proposed in this paper uses LabVIEW at the publisher end and any computing device having either a browser or a stand-alone application designed for accessing Remote Laboratory, at the subscriber end.

### II. DESIGN

The architecture of the proposed system is shown in Figure 1. For experimentation purpose, we choose any computing device in the subscriber side. This computing device will have an application that makes use of the SCCT add-on for communication with publisher, i.e. the remote server [3]. The remote server will be connected to the experimental set-up via the DAQ module [11]. DAQ is used for two purposes- for acquiring control signals from the subscriber side and also for acquiring data from the experimental set up via sensors.

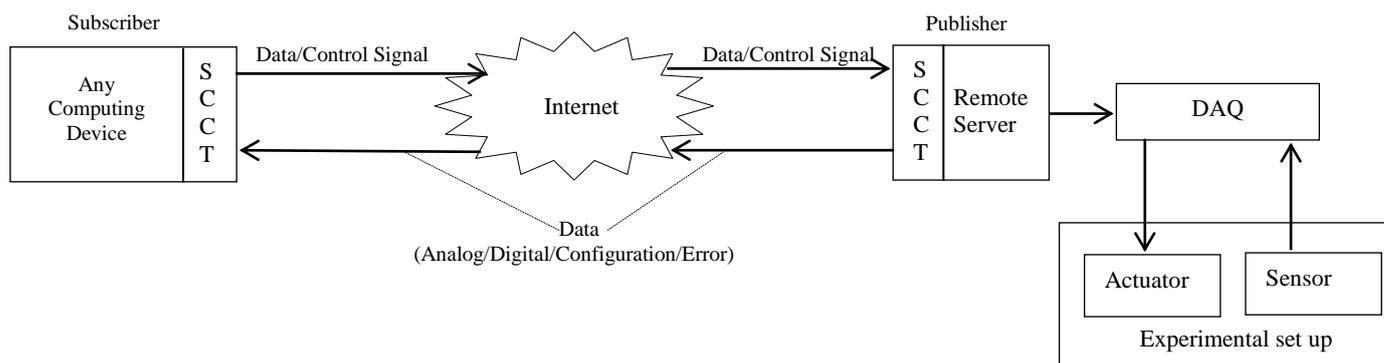


Figure 1. System Architecture of Remotely activated Virtual Laboratory

Initially, when a user furnishes the input through the computing device, a control signal will be generated which will be transmitted to the remote server via Internet. Now, the input module of DAQ will acquire the control signals and transmit them to the experimental set-up for triggering the experiment.

Once the output values are available from the sensors, the output module of the DAQ acquires it and transmits it to the subscriber via Remote server and Internet. Along with the data acquired (analog/digital), the remote server can also send configuration or error messages. These can be separately received in the subscriber application using the appropriate listeners provided by the SCCT add-on. The user/subscriber need not worry about the communication establishment, data transfer, channel maintenance and termination as these will be handled by SCCT [10]. SCCT provides simple interface to the user for programming the communication tasks.

### III. EXPECTED RESULTS

The proposed work is still under development and it is expected that the once the work is completed, the experimental set up situated at a remote location, must be able to initiate itself on being triggered by a subscriber. Once the output values are generated by the experiment, it should be made available to the subscriber in the form of chart or a graphical plot. Users can refer the graphical plots obtained and perform the required analysis and calculations.

### IV. CONCLUSION AND FUTURE WORKS

By the proposed work, a new way of setting up a virtual laboratory is given. This will improve the quality in the field of education, especially in the professional courses like Engineering, Research and Medicine.

Development of subscriber side applications for smartphones and Personal Computers and for various smartphone platforms like Android, iOS, windows etc. Time slot based access for different users can be provided for the smooth running of the set-up. When one user is performing the experiment, other users can only view the results of the current experiment and will have to wait for their time slot to perform the experiment.

### ACKNOWLEDGMENT

The authors duly acknowledge the support provided by the Centre for System Design (CSD): A Centre of excellence at National Institute of Technology-Karnataka, Surathkal. We specially thank Dr. K.V.Gangadharan, Professor&Head, Department of Mechanical Engineering, NIT-K, Surathkal for his valuable support and guidance.

### REFERENCES

- [1] Javier Garcia -Zubia, Pablo Orduña, Diego López-de-Ipiña, and Gustavo R. Alves, (2009),“Addressing Software Impact in the Design of Remote Laboratories”, Industrial Electronics, IEEE Transactions on (Volume:56 , Issue: 12 ), 4757 -4767
- [2] National Instruments “Distance-Learning Remote Laboratories using LabVIEW.”

- [3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
- [4] Gomes, L., and J. Garcia-Zubía, Advances on remote laboratories and e-learning experiences. Univ. Deusto, Bilbao, 2007.
- [5] Coito, F., and L. Brito Palma, "A Remote Laboratory Environment for Blended Learning", PTLIE Workshop - Pervasive Technologies in E/M Learning and Internet based Experiments, 1st ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2008), July 16-18, Athens –Greece, 2008.
- [6] Coito, F., P. Almeida, and L. Brito Palma, "SMCRVI – A LabVIEW/Matlab based Tool for Remote Monitoring and Control", 10th IEEE International Conference on Emerging Technologies and Factory Automation, Sept 19-22, Catania, Italy, 2005.
- [7] Amadou, M., M. Saad, J. Kenné, and V. Nerguizian, "Virtual and Remote Laboratories", 1st IEEE International Conference on E-Learning in Industrial Electronics, Dec. 18-20, Hammamet -Tunisia, 2006.
- [8] NIT-K Virtual Lab Web Page: [nitk.vlab.co.in](http://nitk.vlab.co.in)
- [9] NIT-K Remote Triggered Lab Web Page: [rtlabs.nitk.ac.in](http://rtlabs.nitk.ac.in)
- [10] T4SM SCCT Webpage: [sine.ni.com/nips/cds/view/p/lang/en/nid/210042](http://sine.ni.com/nips/cds/view/p/lang/en/nid/210042)
- [11] National Instruments Web Page: [www.ni.com](http://www.ni.com)