

## AQAR 2019-2020

### Best Practice 1

#### 1. Title of the Practice: V-Lab Nodal Centre under NMEICT of ME (MHRD), New Delhi

Kolhapur Institute of Technology's College of Engineering (Autonomous), Kolhapur is registered as **V-Lab Nodal Centre (NC 08) under College of Engineering Pune**. Virtual Labs project is an initiative of Ministry of Human Resource Development (MHRD), Government of India under the aegis of National Mission on Education through Information and Communication Technology (NMEICT). This project is a consortium activity of twelve participating institutes and IIT Delhi is coordinating institute. It is a paradigm shift in ICT-based education. Under Virtual Labs project, over 120 Virtual Labs consisting of approximately 900+ web-enabled experiments were designed for remote-operation and viewing. The Virtual Labs are being jointly developed by IIT Delhi, IIT Bombay, IIT Madras, IIT Guwahati, IIT Roorkee, IIT Kanpur, IIT Kharagpur, IIIT Hyderabad, Amrita Vishwa Vidyapeetham Coimbatore, College of Engineering Pune, Dayalbagh Educational Institute Agra and NITK Surathkal.

Physical distances and the limited availability of resources often put restrictions on conducting experiments especially when they involve sophisticated instruments. Virtual Labs have been designed to provide remote access to labs in various disciplines of Science and Engineering. These Virtual Labs cater to students at the undergraduate level, post graduate level as well as to research scholars. Virtual Labs enable the students to learn at their own pace and enthuse them to conduct experiments. Virtual Labs also provide a complete learning management system where the students can avail various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self evaluation. Virtual Lab enables the user to perform experiments remotely as an on-demand service over the web.

#### 2. Objectives of the Practice

1. To provide remote-access to Labs in various disciplines of Science and Engineering.

These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars.

2. To enthuse students to conduct experiments by arousing their curiosity.

This would help them in learning basic and advanced concepts through remote experimentation.

3. To provide a complete Learning Management System around the Virtual Labs where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self-evaluation.

4. To share costly equipment and resources, which are otherwise available to limited number of users due to constraints on time and geographical distances.

#### 3. The Context

Traditional lab training is challenging, can be dangerous, or even impossible in some cases.

Challenges with traditional lab training:

1. Limited or no access to physical laboratories. Students and employees don't necessarily have access to a lab at any time (e.g. due to social distancing guidelines because of a pandemic due to limited capacity).
2. Risk of accidents. Experimenting with equipment and hazardous substances is particularly dangerous when learners are inexperienced.
3. Expensive lab equipment. Learners do not get to experiment with modern, advanced machines as they are often out of budget. Therefore, their learning experience is incomplete.
4. Crowded labs. Equipment and materials are limited. Not every learner will have the chance to play around and conduct experiments first-hand.
5. Low priority for learning. Few companies are able to afford equipment used specifically for training purposes. When machines and programs are used for actual work, little or no time is left for learning.
6. Lack of engagement. Common limitations of physical labs (e.g. inadequate number of machines, outdated equipment, etc.) turn learners off. If they can't practice what they're learning in theory, it's harder to understand complex concepts and stay motivated.

Therefore, Virtual Lab will be the best solution to above problems. Virtual labs help build a realistic learning environment so that learners get complete training and are more prepared.

#### **4. The Practice**

Conducting joint experiments by two participating institutions and sharing costly resources has always been a challenge. With today's internet and computer technologies the above limitations can no more hamper students and researchers in enhancing their skills and knowledge. Also, in a country like India, costly instruments and equipment need to be shared with fellow researchers to the extent possible. Web enabled experiments can be designed for remote operation and viewing to enthuse the curiosity and innovation into students. This would help in learning basic and advanced concepts through remote experimentation. Today most equipment has a computer interface for control and data storage. It is possible to design good experiments around some of this equipment, which would enhance the learning of a student. Internet-based experimentation further permits use of resources, knowledge, software, and data available on the web, apart from encouraging skillful experiments being simultaneously performed at points separated in space (and possibly, time).

In initial stage, this practice was carried out in the following flow:

1. Being an NMEICT-MHRD initiative, MoU for Virtual Lab with COEP for KITCoEK as a Nodal Center was signed.
2. Ms. Shivani Kale, Assistant Professor, Department of Computer Science and Engineering, KITCoEK was deputed as Nodal Officer.
3. Next, to percolate the Virtual Lab activities, department wise faculty coordinators were appointed
4. Students and faculties were registered on Virtual Lab portal under KIT as Nodal Center
5. Various workshops were conducted on Importance of Virtual Lab for faculty as well as students.
6. Students and faculty participated in Virtual lab Content Development Hackathon

7. Students and faculty used Virtual Labs of different engineering discipline of different institutes such as IIT Hyderabad, IIT Dayalbagh, IIT Delhi, IIT Kharagpur, IIT Kanpur, Amrita Lab, College of Engineering, Pune, etc.
8. Virtual Lab usage report submitted to COEP after completion of every semester.

## 5. Evidence of Success

1. Students received online practical experience during the pandemic increasing the usage of Virtual Labs to 40%.
2. Students and faculties got familiar with how Virtual Labs work and have participated and won **Silver Developer Certificate for "Virtual lab Content Development" at BIET Jhansi in e-BOOTATHON: A National Level Hackathon for virtual content development** sponsored by TEQIP-III organized by Bundelkhand Institute of Engineering and Technology, Jhansi in association with IIT Kanpur, Rajkiya Engineering College, Banda and AKTU Lucknow.
3. The institute has started its own virtual lab content development according to curriculum by starting Virtual Lab@KITCOEK-Pre-Incubation Start Up Project under KITE in which 200 students from all departments are working.

## 6. Problems Encountered and Resources Required

Initially, the idea of practicing virtually was quite strange for students as well as faculties as, normally, the word 'practical' denotes hands on activities. Therefore, it took some time to make them aware about the actual benefits of the Virtual Lab. Talking about resources, there is a need of a dedicated server with 24/7 internet facility so that high quality streaming takes place.

### Notes: Benefits of using V Labs

Virtual Labs will provide to the students the result of an experiment by one of the following methods (or possibly a combination).

- Modeling the physical phenomenon by a set of equations and carrying out simulations to yield the result of the particular experiment. This can, at-the-best, provide an approximate version of the 'real-world' experiment.
- Providing measured data for virtual lab experiments corresponding to the data previously obtained by measurements on an actual system.
- Remotely triggering an experiment in an actual lab and providing the student the result of the experiment through the computer interface. This would entail carrying out the actual lab experiment remotely.
- Virtual Labs will be made more effective and realistic by providing additional inputs to the students like accompanying audio and video streaming of an actual lab experiment and equipment.
- Reduce costs. Purchasing a high-end simulator for training sounds — and is — expensive. But, in comparison, getting multiple devices so employees can get trained in a physical space is more costly. Besides, maintaining all this equipment will cost more than maintaining one platform.
- Guarantee safety. In a virtual laboratory, learners can try all kinds of experiments without the risk of damaging equipment or injuring themselves. They can also test different

scenarios, compare, and determine which one is the most effective without having to try them out in real life.

- Create a true-to-life learning experience. Often learners have to make guesses about how a machine operates, what the outcome of a piece of code will be, etc. They may also ignore limitations or malfunctions that could happen in a real work environment.