

VlabMS

Virtual Lab Management System

Background

Effective and efficient learning especially for science, computer science and engineering courses requires a mixture of both theoretical knowledge and hands on experience or practical work. The revolution in Internet Technology and the boom of e-learning and virtual environments have enabled a number of web-based software systems to provide remote hands-on-experiences to the learners through computer simulations. In a virtual laboratory system the users gain knowledge through demonstrations and simulations which are guided by hyper-text documents.

The first step to be taken was to design a proposal for the development and implementation of virtual lab. After initial meetings with Prof. Sunita Malhotra, Prof. Vijayshri, Dr. Shubha Gokhle, Prof. Javed A. Farooqi, Dr. Lalitha S. Kumar, (Physics and Chemistry faculty) of School of Sciences, a brief presentation was given by the NCIDE faculty on the concept, components, various phases and outcome of development and implementation of the virtual lab. It was decided by NCIDE and SOS that initially a prototype of the virtual lab known as virtual lab management system (VlabMS) will be developed with a few basic experiments in Chemistry viz. how to use an analytical balance, preparation of a standard solution and acid base titrations and for Physics it was decided to develop a virtual experiment on Cathode-Ray Oscilloscope (CRO). A detailed proposal was made with specifying clearly the objectives, activities and requirements for the design and development of the virtual lab. The proposal was approved in December 2006 and to begin with at the initial stage, a country wide educational broadcast was conducted to sensitize the IGNOU functionaries and learners about the concept of virtual laboratory. Eminent experts from IGNOU, and IIT, Delhi participated in the programme.

Thus, NCIDE developed a prototype of an interactive, multimedia-rich virtual laboratory system for science education at a distance. The VlabMS hosted open source experiments in Physics and Chemistry. The learner-friendly features of the VlabMS allow the learners to access it anytime anywhere : to view lab practical demonstrations; to perform selected lab experiments in a simulated environment; and to interact with their mentors and peer groups both synchronously and asynchronously in a digital environment.

Need of Innovation

In general for a practical based course offered through open and distance learning, it is essential for the learners to go through a lab work. In case of IGNOU the practical based programmes have study centres in well-established reputed colleges in various cities of the country. The required resources like laboratory for conducting the practical, and classroom to conduct counselling for the programmes are provided by the concerned college. However, the laboratory in the colleges is used by IGNOU students during winter and summer vacations of the college. This results in less coordination between theory and practical work. As the time period to perform both guided and unguided practical experiments for the learners of practical based programmes of IGNOU is limited, students have no facility to repeat the experiments. They also required maintaining laboratory work book/manual.

As a response to the above problems, a need was felt to initially develop a prototype of VlabMS for elementary Physics and Chemistry experiments for B.Sc. learners as a cost-effective solution with omnipresent facility and a value addition to practical component.

It was proposed to design and develop a prototype of interactive multimedia rich virtual laboratory for distance science education that allows students to practice and perform laboratory experiments from remote locations through a web browser or offline through multimedia CDs.

Description of the Innovation

Open and distance learning systems worldwide are seeking innovative mechanisms of providing laboratory experiments through computer mediated simulations and demonstrations. In 2006, NCIDE in collaboration with School of Sciences envisioned developing a Virtual Laboratory (Vlab), for distance science learners in the beginning which would provide an innovative and timely solution to the learning problems of distance science learners in India. It was expected that the virtual laboratory would allow the students to practice and perform laboratory experiments from remote locations through a web browser or offline through multimedia CDs. However, due to resource constraints a prototype of the virtual laboratory known as VlabMS, which was first of its kind in India, was designed and developed with the available resources in 2006-2007. This was further extended to hosting OER based lab resources which was accessible to any interested learner. Later in 2010 the web-enabled module of the computer Literacy programmes consisting of about 800 simulations, demonstrations and evaluation for the learners, to experience hands on training of the lab component of the Computer Literacy Programme, were integrated in the VlabMS. Thus, this platform became useful to the learners to gain information and knowledge just when it is required. It is more interactive and can send information and receive feedback.

The entire prototype development process was divided into the following phases as mentioned in Figure 1.

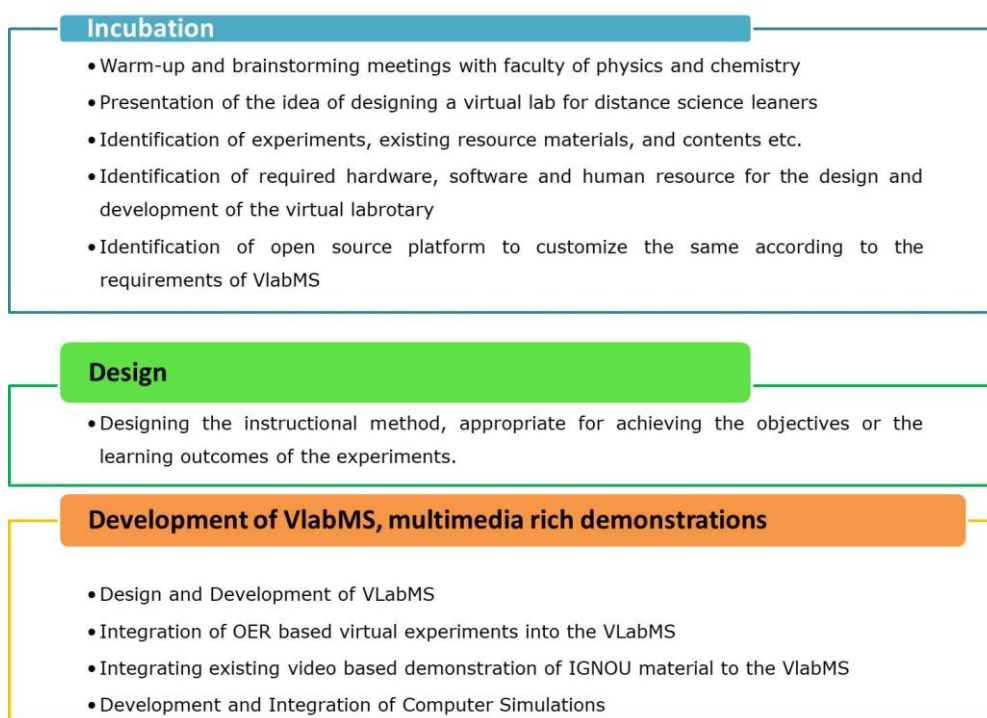


Figure 1 : Phases of Prototype Development of VlabMS

Everything was moving at the right pace, however there were certain constraints like availability of appropriate hardware and software. Human, the following creative ideas were implemented by the innovator to overcome the hurdle :

- a. Open source Learner Management System like Moodle was customized into a virtual laboratory management system named as VlabMS.
- b. In view of the philosophy that something is better than nothing, it was decided to make one of the oldest servers available in the NCIDE lab to host the portal.

The faculty of NCIDE took interest in even designing and developing at least one experiment in chemistry as a prototype. The Chemistry faculty facilitated NCIDE in providing lab manual and video lectures for the experiment on titration.

Innovative Features

The VlabMS was based on an innovative methodology viz. look, practice, access, collaborate and communicate. Each of them is explained below with pictorial view.

Look and Practice : The VlabMS has interactive multimedia rich lab practical demonstrations both in-house built and OER based which enable the learner to gain knowledge on the contents of the experiment. This component consists of all tailor-made useful and important basic concepts and theories in interactive multimedia format that a learner will require to perform the laboratory experiments both through the virtual environment or study centre lab. It also has a ready reference material of Lab manuals in digital format (for a few experiments). All this enables the student to gain knowledge on all necessary and relevant topics before actually performing the laboratory experiments. Through the practice mode the learners can learn more effectively, if they have the opportunity to conduct experiments on their own in a virtual environment. This component of the VlabMS deals with interactive computer simulation that makes the virtual laboratory experiments more interactive, attractive, easily accessible and easier to perform. (See Figures 2, 3, 4 and 5).



Figure 2

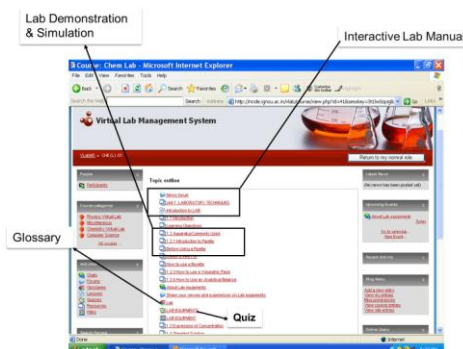


Figure 3

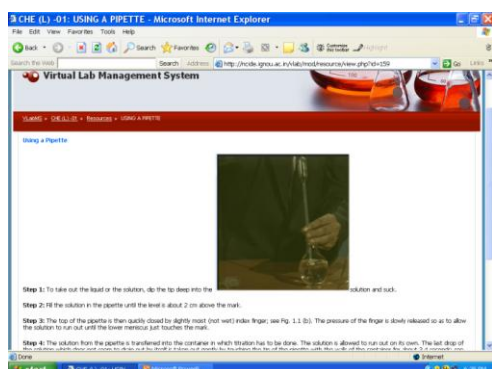


Figure 4

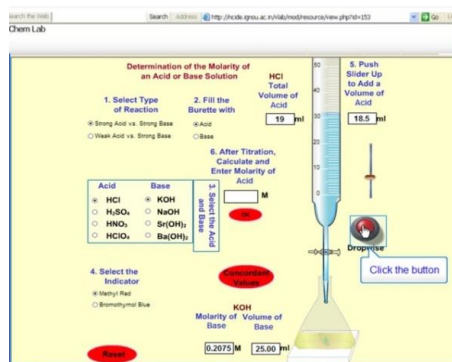


Figure 5

Assess : Once the learners have gone through the lab demonstration and practiced through simulations they can assess their skills in a simulated environment.

Collaborate and Communicate : The learners, through the VlabMS platform can collaborate and communicate through e-mail, chat, discussion board, blogs with their mentors and peer group. (See Figure 6).

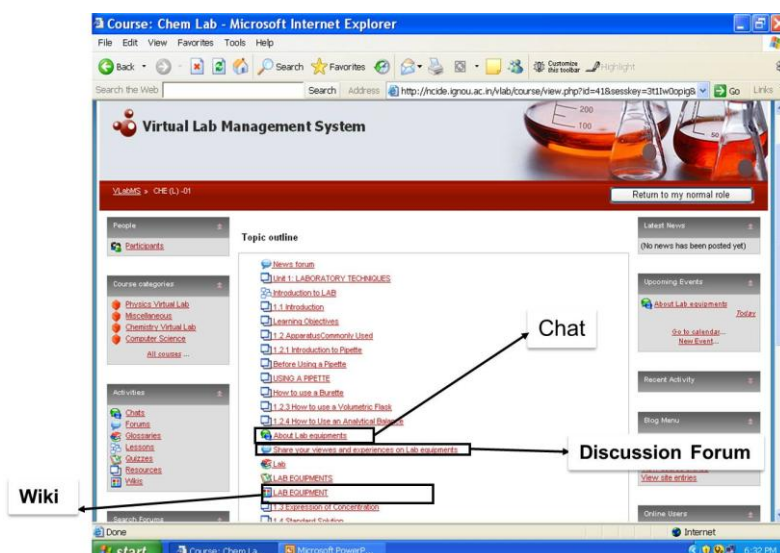


Figure 6 : Collaboration and Communication Feature of VlabMS

It has inbuilt Online Evaluation System.

Achievements

The concept of virtual lab with content and learner management facilities was a new idea. VlabMS was probably the first portal of its kind. An open source management system was identified to make virtual lab with all the content management and learner management facility. The portal hosted OER based virtual experiments. Simulations and demonstration related to basics of word, power point and how to operate a computer were also hosted. Since anyone could register into the platform. Several students from India and abroad accessed the platform.

Applications and Uses of the Innovation

The VlabMS was available on the NCIDE server for a few years, where users through simple registration could access OER based virtual experiments in the field of chemistry, physics and basics of computer science (learning word, PowerPoint, excel etc.) through the VlabMS.

Way Forward

As the VlabMS portal is a multi-admin, multi-user, platform independent technology which has the scope of complying with the latest WC3 standards, can be used to integrate the virtual experiment components of any practical based programme in various subjects. The VlabMS portal can be used for learning in the classroom, as well as to cover the absence of weakness or lack of facilities in the laboratory instrumentation or real laboratory. A thorough review of literature was conducted and presented [1] keeping in view of the pedagogical, technological, managerial, and innovational dimensions for developing a virtual laboratory. (See Figure 7.)

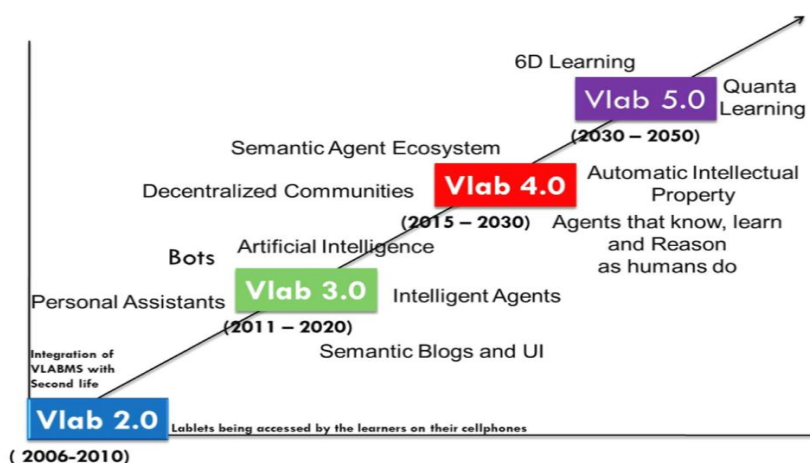


Figure 7 : Landscape of Virtual Laboratory for Distance Science Education¹

Coordinator and Innovator

Dr. Jyotsana Dikshit

Facilitators :

Prof. Sunita Malhotra, Prof. Vijayshri, Prof. Shubha Gokhle, Prof. Javed A. Farooqi, Dr. Lalitha S Kumar SOS, IGNOU, New Delhi-110068

Period : 2006-2011

Reference

1. Presented a conference paper on **Virtual Laboratory for Distance Science Education**, Dated : February 25, 2010, International Conference on Digital Libraries, 2010.