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GOVERNMENT OF INDIA
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VIRTUAL LABS PROJECT LAUNCHED

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The Union Minister for Human Resource Development, Government of India today launched Virtual Labs — a collection of ninety-one virtual laboratories containing hundreds of experiments in nine disciplines of science and engineering. As part of Ministry of Human Resource Development(MHRD)'s National Mission on Education through Information and Communication Technology (NMEICT), Virtual Labs is part of a comprehensive undertaking to provide easily accessible and high quality education throughout India.

Virtual Labs' primary focus is to provide graduate and undergraduate college and university students with the ability to perform their required laboratory experiments using only the World Wide Web, a standard computer, and an Internet connection. Virtual Labs allow students to practice and better learn the science and engineering behind the experiments that they are required to perform. Virtual Labs also allows the sharing of costly equipment across the country, and in very rural areas, students will be able to perform experiments that they would not otherwise be able to access.

Nearly 300 department heads, faculty, and staff representing 152 institutions have been trained across India. Over 20 Nodal Centres have been created, institutions who have expressed their interest to champion Virtual Labs in their organisations and geographical areas.

The Pilot Phase of the Virtual Labs project started in April 2009. During this phase, approximately twenty labs were developed as proof of concept. The Main Phase began in April 2010. So far, over 80 Virtual Labs have been developed, and are undergoing field trials in various parts of the country.

Two types of virtual labs have been developed under this project. In the **Simulation Based Virtual Labs** the experiments are modeled using mathematical equations. The simulations are carried out remotely at a high-end server, and the results are communicated to the student over the internet. Simulation based Virtual Labs are scalable and can cater to a large number of simultaneous users.

Using the **Remote Triggered Virtual Labs** the actual experiments are triggered remotely. The output of the experiment (being conducted remotely) is communicated back to the student over the internet. This class of Virtual Labs gives the student the output of real-time experiments. Typically, time-slots are booked before conducting such experiments.

All Virtual Labs can be accessed through a common website: www.vlab.co.in. At the user end, a PC and broadband connectivity enables the user to access Virtual Labs.

These Virtual Labs will be very useful for Engineering College Students who do not have access to good lab-facilities, High-school students, whose inquisitiveness will be triggered, possibly motivating them to take up higher-studies, Researchers in different institutes who can collaborate / share equipment and engineering colleges, who can benefit from the content and related teaching resources.

Currently 85 Virtual Labs have been developed comprising of 769 experiments. Trainings and workshops have been held all over India to disseminate knowledge of these Virtual Labs. Future efforts will involve development of virtual labs in different subjects and wide dissemination of this knowledge.

A Collaborative Platform for Development of Virtual Labs has been created that assists the faculty with authoring and maintaining Virtual Labs. The platform hosts over 825 experiments developed by many of the partner institutions. The Collaborative Platform provides the server side architecture for ensuring that virtual labs run securely, can effectively serve thousands of students simultaneously, and reserve time slots for experiments that require scheduling. The Collaborative Platform also provides tools to help teachers monitor their students' progress and make changes to the instructional material.

Student interest in Virtual Labs has also been enthusiastic. The Virtual Labs site (vlab.co.in) has had 233,570 site visits and 1,034,443 page visits in just the last 6 months. There are over 4500 registered users from 134 countries and handles around 100GB of traffic per month with visitors from India, United States, Malaysia, Philippines, United Kingdom, Australia, Canada, Germany, Pakistan and so on.

With the launch of Virtual Labs Indian students will have easy access to an encyclopedia of science and engineering knowledge presented in a way that is engaging, immersive, and enjoyable. Virtual Labs will allow students to explore, discover, and learn wherever they are and at their convenience.

List of Virtual Labs that are ready

A.   Electronics & Communications
- Virtual Advanced Lab for Interactive Design and Test in Electronics
- Virtual Microwave Laboratory
- Wireless Lab
- Engineering Electro-magnetics Laboratory
- Queuing Networks Modelling Lab
- Hybrid electronics Lab
- RF microwave characterization Lab
- Transducer and instrumentation virtual lab
- Electronic design using DSP,FPGA,CPLD and Micro controllers through simulation and direct access of the hardware
- Digital Electronic Circuits Laboratory
- Digital Signal Processing Laboratory
- Fading Channels and Mobile Communications
- Basic Electronics
- Systems, communication and control laboratory
- Speech Signal Processing Laboratory
- Digital VLSI Design Virtual lab
- Signals and Systems Laboratory
- Electromagnetic Theory
- Virtual Electric Circuits

B.   Computer Science & Engineering
- Problem Solving
- FPGA & Embedded systems lab
- Computer Architecture & organization

- Advanced Network Technologies
- Software Engineering
- Data Structures
- Computer Programming
- Data Mining
- Databases
- Computer Organization
- VLSI
- Digital Logic Design
- Speech Signal Processing
- Mobile Robotics
- Computer Graphics
- Image Processing
- Pattern Recognition
- Artificial Neural Networks
- Virtual Advanced VLSI Lab
- Cryptography Lab

C. Electrical Engineering

- Sensors Modeling & Simulation
- Industrial Automation Laboratory
- PLC
- Analog Signals, Network and Measurement Laboratory
- Real Time Embedded Systems Laboratory
- Electrical Machines Laboratory
- Creative Design, Prototyping & Experiential Simulation Lab
- Ergonomics Lab for Assessing Physical Aspects of Design
- Virtual English and Communication
- Virtual Anthropology Lab

D. Mechanical Engineering
- Metal Forming Lab
- Vibration and Acoustics
- Micromachining laboratory
- Kinematics & Dynamics of Mechanisms
- Mine Automation and Virtual Reality

E. Chemical Engineering
- Process control, reaction engineering and unit operations lab
- Chemical Engineering
- Simulation of Control of Magnetic Levitation System
- Virtual Lab for Mass Transfer

F. Biotechnology and Biomedical Engineering
- Bioreactor Modeling & Simulation lab
- Biomedical and Signal processing Laboratory
- Virtual Proteomics Laboratory

- Neurophysiology (pilot)
- Neuron Simulation Lab (pilot)
- Biochemistry Virtual Lab I
- Biochemistry Virtual Lab II
- Population Ecology I
- Population Ecology II
- Immunology Virtual Lab I
- Immunology Virtual Lab II
- Microbiology Virtual Lab I
- Microbiology Virtual Lab II
- Molecular biology Virtual Lab I
- Molecular biology Virtual Lab II
- Cell biology Virtual Lab I
- Cell biology Virtual Lab II

G.   Civil Engineering

- Strength of Materials Lab
- Fluid Mechanics Lab
- Soil Mechanics Lab
- Basic Structural Analysis Lab
- Surveying Lab

H.   Physical Sciences

- Physical sciences
- Virtual Advanced Mechanics Lab
- Virtual Optics Lab
- Virtual Electricity & Magnetism Lab
- Virtual Heat & Thermodynamics Lab
- Virtual Modern Physics Lab
- Virtual Harmonic Motion and Waves Lab

I.   Chemical Sciences
- Analytical Lab
- Virtual Chemistry Lab
- Virtual Lab in "Charge and Particle size Determination in Colloidal Systems"
- Virtual Lab in "Absorption Spectroscopy"
- Virtual Lab in "CD Spectroscopy"
- Physics of Biomolecules
- Physical chemistry lab
- Physical Chemistry
- Organic Chemistry
- Inorganic Chemistry

MC/GK