

## E-Laboratory in Education System

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**Abstract:** Internet technology has provided further teaching and learning ways in today's world. At present, most institutes prefer the concept of Learning Management System/E-Learning for improving their learning system. The proposed system E-laboratory has various programming languages that can be accessed through the internet, remotely by the student, distance learners, and staff members. During this pandemic COVID-19 situation, the E laboratory (E-LAB) plays a vital role in the education system for gaining hands-on experience in accessing various tools and applications remotely. It is very much helpful in these situations for everyone to work and learn in a self-paced manner.

**Keywords:** E-laboratory, E-learning, COVID-19.

### 1. Introduction

The rapid development of Internet technology and its improving quality has an enormous impact on current trends. Laboratories are one of the most essential in learning technologies. E-lab is a laboratory that is different from the traditional laboratory. In a usual laboratory, a single teacher cannot supervise the overcrowded classes. And they can't monitor and check the student activities every time during the session. It also takes a lot of time to install the required application in all the systems. So, the students can't acquire as much knowledge in practical works other than the scheduled time. In E-Laboratory, the students can access it through PC/laptop or even through mobile phones with internet connectivity. Programming is one of the essential skills at the introduction of level courses in engineering streams. It facilitates them in learning basic and advanced ideas through remote experimentation. The students can avail themselves of various tools for implementing the programming language through web resources, video lectures, and self-evaluation by using E-lab. This system maintains updated information of all details like courses, assignments, exams, and all pieces of information. The biggest challenge is allowing students to take advantage of learning technology while keeping the class productive and well managed at their place. "Learning from failure" is one of the most effective ways of learning. E-laboratory permits students to repeat the programming experiments multiple times.

#### 1.1. Problem Statement

In the traditional lab, it has various tools and applications for specific courses. All courses use different types of applications. So, the required applications have to be installed in all the systems as per the requirement. At some stage, we might lose some of the applications in the system. The students can implement their experiments only during lab hours. They cannot complete their assessment at the given time, so they have to wait until the next lab session. And the staff cannot inspect and monitor all the students every time. Due to this, the students may not obtain as much knowledge in the hands-on experience. It takes a lot of time and cost to install the applications in the system.

#### 1.2. Aim & Objective

The main aim of E-lab is to provide a complete Learning Management System. From this, the students can avail themselves of the various tools for learning free of cost. And to give access to labs in a wide range of disciplines in engineering remotely.

### 2. Method

The E-laboratory system is a web-based application that offers various significant features that support a modern laboratory. It helps the students to increase their level of hands-on experience in a self-paced manner. In recent days most organizations prefer virtual labs(E-Lab) to traditional laboratories. This system has developed using Asp.net and SQL server management systems. It can be accessed remotely through Laptop/PC or even by using their mobile phones, anywhere at any time. It has three main modules admin, staff/instructor, and student modules. In the admin module, the admin can maintain the records and add or remove the users(instructor and student). In the instructor module, the instructor can assign tasks and conduct examinations through this platform. Also, the instructor can verify and evaluate the assigned task and exams of all the students manually. In the student module, the students can examine and implement the assessment. After

completing the allocated task take a screenshot of the output and submit it for evaluation purposes. Also, students can view their marks in this module. Our system keeps all the records like attendance and marks.

### 3. Module Description

This system consists of eight modules which described with the flow diagram (figure 1) in this section.

#### 3.1. Registration Module

This module is for creating a new account for the new user to gain access to the website. A user can have only one account. It's a one-time registration. All the information about each user, like username and password, is stored in the database.

#### 3.2. Login Module

A login module is designed mainly for authentication purposes. It's a security measure planned to stop unauthorized users from getting access to our website. The registered users can log in to their accounts, and they can use this platform for implementing programs. If the entered username and password don't match, the user can change the password by clicking forget password.

#### 3.3. Student Module

In this module, the student can select the relevant semester and subject name/code, and then they can view their assigned work and marks for the assigned task. The students have to follow the deadline to submit their assignments/exams, given to them by their instructor. After implementing the programs, the student has to take screenshots of the output and upload them for further evaluation.

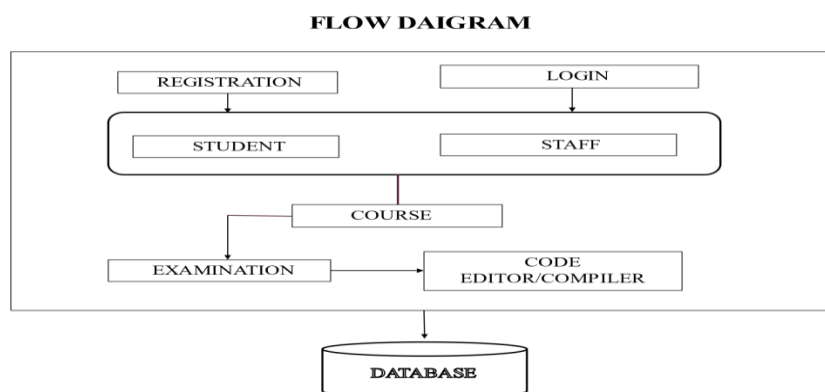


Figure 1. Flow Diagram

#### 3.4. Staff Module

This module is very much supportive of staff for managing all information. The staff can assign assignments, class tests, upload documents and, conduct exams through this platform. And then, they can visualize the work done by the students and update the marks manually.

#### 3.5. Course Module

This module describes the number of available courses in the system. Only registered students can access this. It also contains the lab manual, which has some sample programs for reference. Here, the course details listed according to the semester. The user can select their current semester by choosing their desired course from this, and then they can implement the programming experiment.

#### 3.6. Integrating Compiler into Website

This module is for implementing programs. It supports 60+ languages like (C,C++,Java,PHP,etc..). Here we have integrated the Jdoodle API into our website. By using our system, it's easy for the staff and the students to teach and learn at their place. It also improves the students learning ability.

#### 3.7. Examination Module

The examination module is for organizing exams through this platform. An examination is one of the most needed in the educational system for evaluating the student's abilities and performance. The staff can conduct exams by allocating time limits for the students through online mode.

#### 3.8. Database Module

Database module permits adding, updating, and deleting data of the users. It saves all information about the users in a database. The user details can be extracted from the database using various filters as per the requirement.

#### 4. Module Implementation

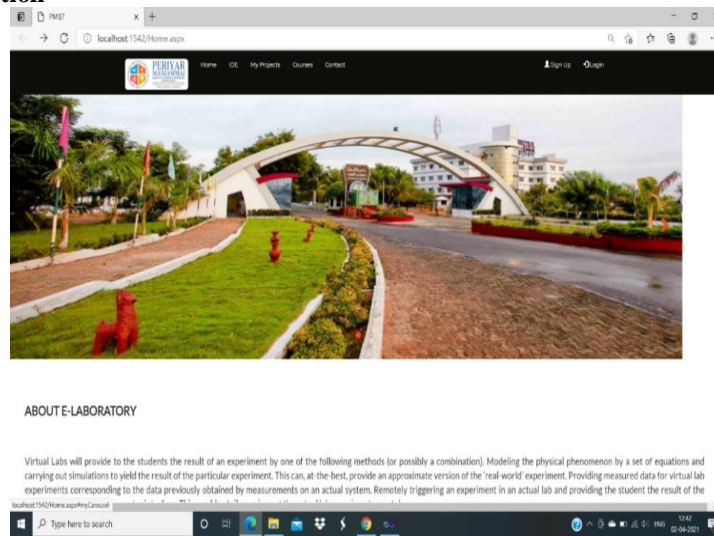


Figure 2. Main page

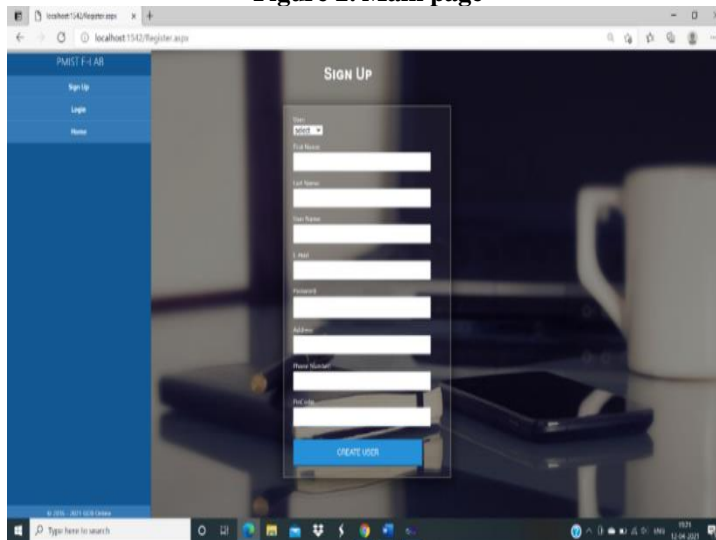


Figure 3. Registration Page

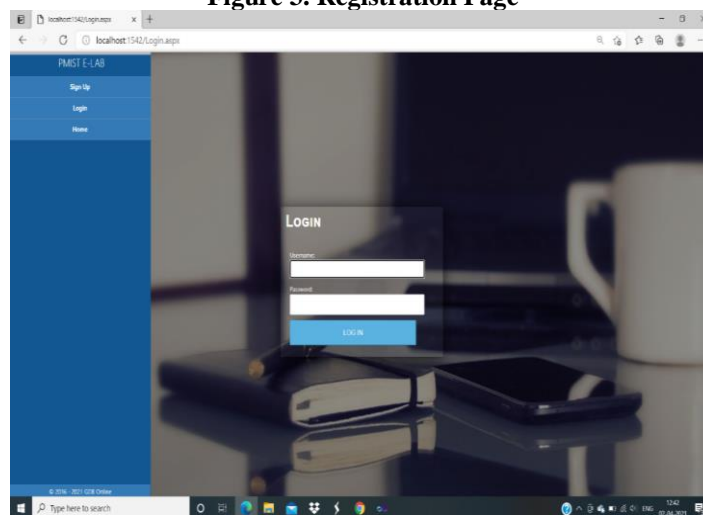


Figure 4. Login Page

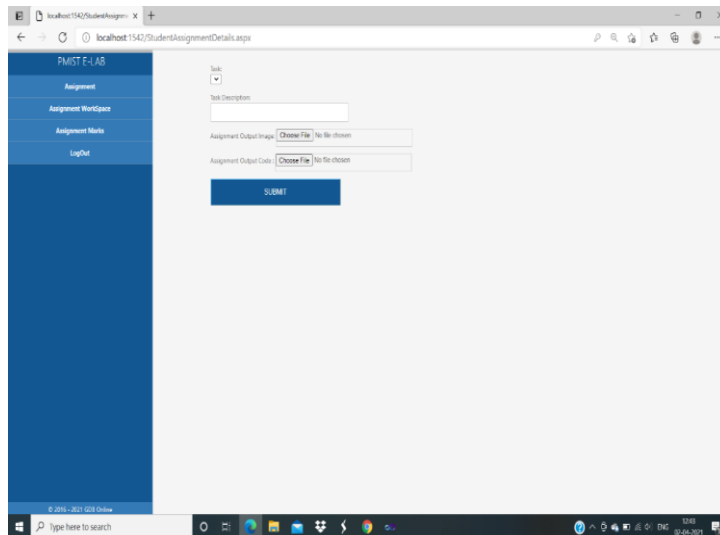


Figure 5. Student Page

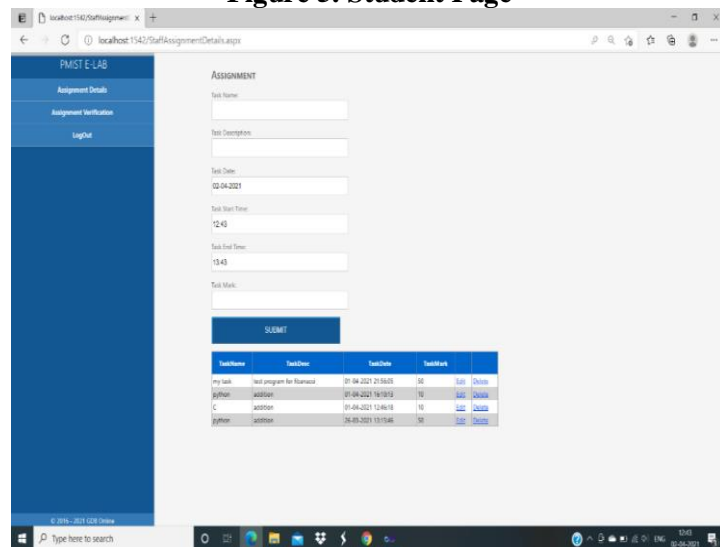


Figure 6. Staff page

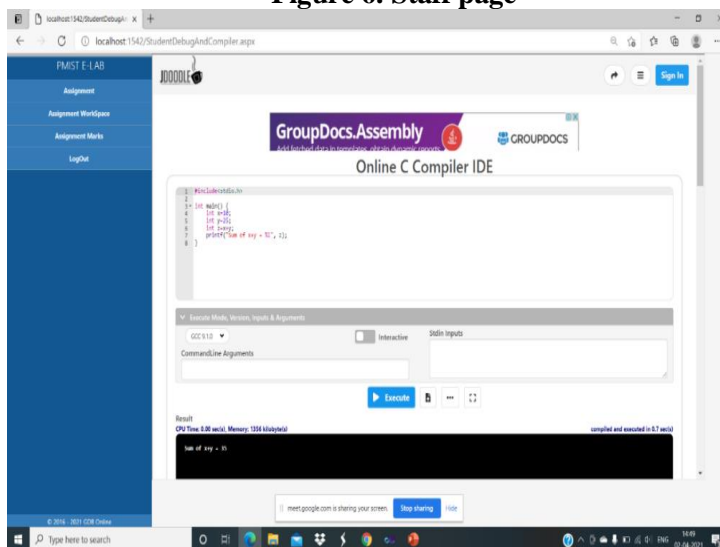


Figure 7. Compiler

### 5. Discussion and Conclusion

This paper addresses many institutional aspects of the lab exercises from the introduction-level programming courses. It can be accessed remotely using their laptop/PC or even through their mobile phones

with good internet connectivity. We try to make things simpler and improve the method of learning and managing simple programming problems. This system predominantly focused on the work done by the students. Here, the function of the instructor is to motivate the students to solve the solutions for most of the problems. It adopts various technologies from a wide range of domains. It reduces the time, cost of travel, and other expenses for the students and the institution. During this pandemic situation COVID-19, It's also essential for the students to acquire knowledge from their homes. It is also helpful for distance learners.

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