

Virtual Lab for an Engineering College

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Abstract— Practical experience is an important component of the educational process. However, the time and economical resources often required for the setting up and construction of scientific laboratories is outside the scope of many institutions. A solution to this problem could be found in the adaptation of the Virtual Reality technology, which could allow the creation of Virtual Laboratories, which will simulate the processes and actions that could take place in real laboratories. In particular, this paper, based on the expertise and motivation gained by the VirRAD-IST project, proposes and describes such an educational virtual laboratory, which aims to meet the requirements of a real laboratory and furthermore to support communication and collaboration services. We propose a web-based system, which allows users to perform experiments on educational fields, such as Programming in Computer Science or Information Technology in multiuser worlds where users are represented by avatars and they are offered a wide range of communication and compilation services in order to simulate efficiently a real learning experimental process.

Key words: World Wide Web (WWW), Virtual Lab for an Engineering College

I. INTRODUCTION

The wide expansion of the World Wide Web (WWW) and the maturation of the Internet along with the step-up of both the network infrastructure and the electronic communication formed all the necessary preconditions for adopting this powerful means of communication for accessional purposes. Regarding the technological field, Virtual Reality (VR) technology has been widely proposed and recognized as a major technological advance for supporting life-long education to individuals along with a flexible workforce.

Most Computer Science departments include an introductory course to Computer Science in their undergraduate syllabi. This introductory course might have one of two different forms. The first form provides the fundamental elements of information technology, making the students skilled to attend and be trained to the majority of the remainder of the courses of the curriculum. This form is usually called Introduction to Computer Science. The second form aims at making students able to use a computer by tutoring them in the most useful and elementary tools for word processing, internet services (eg. browsing, e-mail), spreadsheets, presentations, etc. The latter form is known as Computer Literacy. Although several software products can support the second form, there is a lack of an integrated software to support the first form of courses. Some of the problems involved in the educational procedure of an introductory computer science course are listed below.

- Today's students are already familiar with several computer services (eg. email, internet, etc.). Therefore, they come to the classroom with the impression that an introductory computer science course covers merely what they already know and that such a course has nothing special to add to their knowledge. For this reason, there is a need for students' awareness concerning the context of an introductory computer science course. A virtual lab aims at attracting student's interest and creating motivations that stimulate this interest.
- An introductory computer science course should include lab exercises to help students to take fully into their mind and experience effects of elementary computer science knowledge.
- Due to the diverse curriculum of an introductory computer science course which forms a collection of several different topics, laboratory exercises require many different software and hardware tools (eg. an instrument for the construction of digital circuits, hardware and software to support different operating systems and networks, interpreters, compilers and linkers of different programming languages, etc.) Therefore, a virtual lab consisting of tools and simulators can effectively replace the use of the corresponding necessary equipment and provide equivalent services to support students.
- Physical labs are usually weekly scheduled two-hour and staffed by teaching assistants (TA) to instruct students to accomplish their exercises and to solve their problem sets. Students who might want to use a physical lab more often, complain about this time limitation. Virtual labs are a solution, providing unlimited use of the offering services.

A. Objectives of Virtual Lab

This approach aims at achieving the following objectives:

- A collection of tools and programs in a virtual lab, to assist the educational process of an introductory computer science course.
- To enthuse students to conduct experiments by the arousing their curiosity. This would help them in learning basic and advanced concepts through remote experimentation.
- To provide a 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
- To increase the lab course time to 24/7, but without closing down the physical lab, nor making redundant the teaching assistants,

- To help students to acquire concrete knowledge for abstract concepts by experimentation,
- To attract student's interest and create motivations that stimulates this interest.

The main goal of an Educational Virtual Laboratory is to provide all the simulations, tools, applications and conditions necessary, which will constitute an efficient space where experimentation, communication and collaboration can be used for the maintenance and exchange of rich knowledge.

B. Benefits Virtual Lab

- Significantly reduced cost for the composition of a college laboratory, as it only requires addition of the necessary software to the existing Informatics Laboratory.
- Mistakes of both tutors and learners cannot be proven catastrophic for both the lab and the participants' health.
- The interaction with the virtual environment motivates the users, especially the learners more in regard to the real process.
- It provides the flexible access to students in which they can access through the internet and can do any experiment they have been asked.
- The Instant feedback can be provided by the process of compilation.
- Lower management of Labs
- Remote access to labs.

C. Basic Functionality

Thus, the virtual environment that will host the laboratories, trying to simulate the learning process from its very beginning until its completion, should, first of all, include all the necessary functionality to its users so as to simulate the real processes as more realistic as possible. Thus we are going to build a website which performs several tasks - Online Compilation, Practice programs and Evaluation of Programs.

II. WORKING MODULES

A. Login/Signup Module

As described in earlier section, the faculty can get register and login to upload the materials for the student.

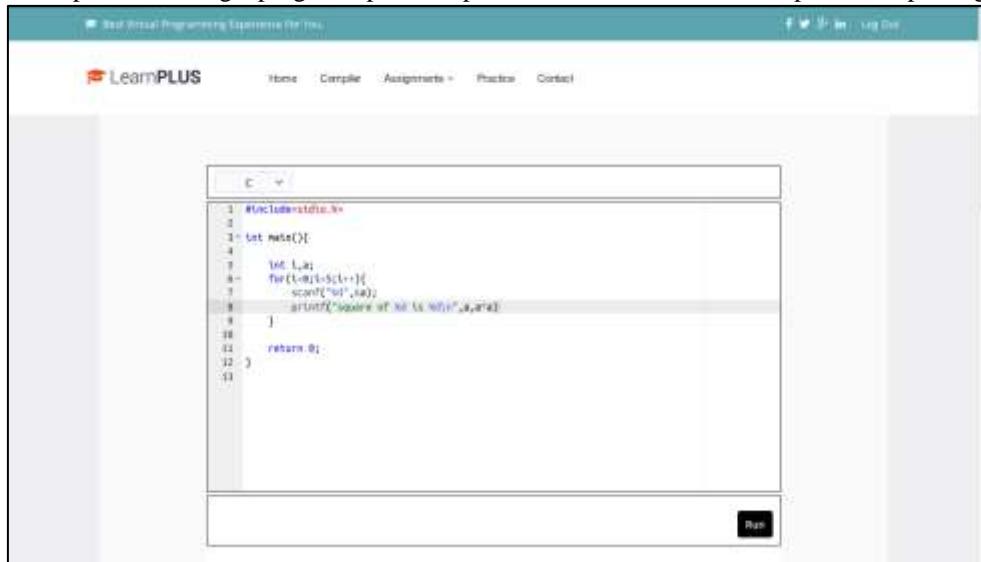
Fig. 1: Showing the Registration Module for faculty to upload the questions and assignments.

Fig. 2: Showing the Registration and Login Module for students

B. Programming Languages

The Programming Languages (PL) module covers the subject of programming languages by providing the following services:

- Code Reading: Code reading is a key method of learning how to write code in any programming language. This service presents useful tools and sources for code reading, and helps users to create a plan of how to be trained to any programming language.
- Choosing a Language: It presents existing programming paradigms (procedural, declarative, functional, and object-oriented) and allows users to understand the relationships and differences between several programming languages with the use of visualized examples.
- Data Structures: It introduces primitive data structures, supports users in distinguishing arrays, records, strings, etc.
- Procedures and Functions: It presents a variety of examples in different programming languages and allows users to comprehend concepts of breaking a program apart into procedural units, their call and parameter passing.



```

1 #include<stdio.h>
2
3 int main(){
4     int i,a;
5     for(i=0;i<5;i++){
6         scanf("%d",&a);
7         printf("value of %d is %d",i,a);
8     }
9 }
10
11 return 0;
12
13

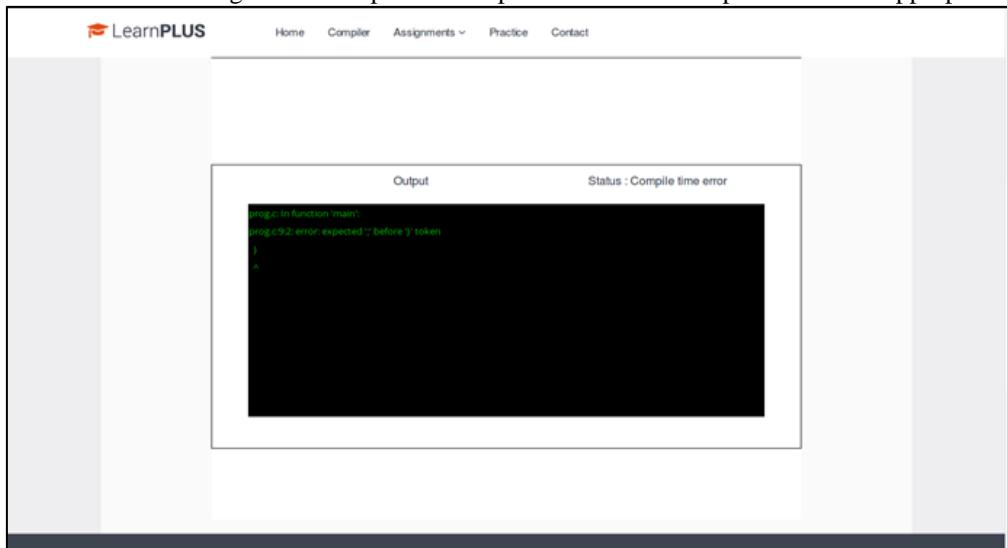
```

Fig. 3: Writing your code before sending it to compilation. You can choose your programming Language.

C. Compilation

The Translation Process: It presents the steps of the translation process by showing the different phases and the intermediate steps for the production of an executable program; it allows users to work with numerous compilers and interpreters of various programming languages and perform comparison tests between them.

In this compilation module we get the file or code from the user and name of programming language used in the code. Then this file is saved in server storage and a compilation script is executed which pass the file to appropriate compiler.



Output

Status : Compile time error

```

prog.c: In function 'main':
prog.c:9: error: expected ';' before ')' token
1
2
3
4
5
6
7
8
9
10
11
12
13

```

Fig. 4: Showing the Compilation Output

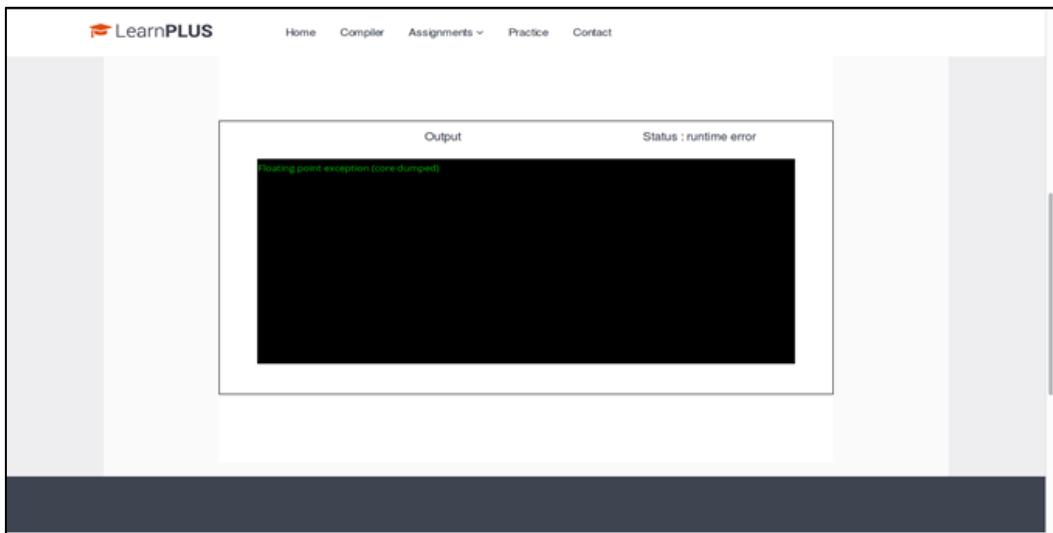


Fig. 5: Showing the Run Time Error

III. CONCLUSION

AS per the existing survey we have come up with the motivation of problems faced by programming labs can be resolved by the virtual lab and it provide a cost effective solution and save time of faculties and student We have gained a practical knowledge from this project, which we think, shall make us stand in a good state in the future.

This Proposed system removes the dependency of compiler installation from the computer lab. And provide a facility to teacher to give assignment online and can check the submission of assignment in his system.

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