An Effective eLearning System for Teaching the Fundamentals of Computing and Programming

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Abstract - **The great enhancement in the current available technology from past recent years has shown its tremendous effect on the quality of education. From past many years students of the first year chemical engineering courses are offered a course of computing and programming to enhance their logical thinking capabilities, to improve their problem solving skills along with the hands on experience on current computer technology. The problem arises with the fact that most of the students belong to rural areas and have no or very little computer related knowledge. This paper is an effort to purpose an effective eLearning system for teaching programming to the students so that their computational and programming skills along with the basic concepts gets improved.**

Keywords- E-learning, Programming, Education, Teaching and Student Learning

I. INTRODUCTION

During the past recent years, the evolving technology has provided number of opportunities for the increased quality of education and learning. With advent of Information and Communication Technologies (ICT), it had become easy for the users to search for resources to study, significance involvement in the paradigm of designing (user-centric designs), changed and improved methods in traditional teaching and learning processes [11] and discovery of the new horizon for education opportunities. This facilitation of learning through electronic means or simply e-learning provides immense opportunities as well as challenges in its implementation and effectiveness [3].

eLearning commonly refers to the effective process created by use of technology (computers, internet connection, CD-ROMs) combined with learning support and services [3]. eLearning is widely in use by educational institutions for the purpose of teaching, businesses for trainings and by individuals for learning.

eLearning have many advantages including convenience for the learner to schedule around his own activities, accessibility to a variety of resources and a wider horizon for educational training and learning. eLearning is normally categorized into four types of variations individualized self-paced eLearning offline, individualized self-paced eLearning online, group-based eLearning synchronously and group-based eLearning asynchronously. The success of eLearning is dependent on the extent to which it satisfies the needs and addresses the concerns of its end users [9].

The instructional system design model of an eLearning system [13] is of vital importance as successful learning experiences and trainings are directly associated with it. Instructional system design focuses on the learning. There are various instructional design models [14], each with its own phases, merits and demerits. Some to be mentioned are ADDIE model, Algo-Heuristic Model, Dick and Carey Model, Robert's Gagne Model, Minimalism, Kemp Morrison and Ross Model, User-Centric Design and Rapid E-Learning Prototyping Model. Further details of these instructional system design models will be covered in the next section.

This review paper examines the various instructional system design models and proposes an eLearning system; for teaching C++ programming; for the students of Chemical Engineering and Technology, University of the Punjab. The primary objective of this eLearning system is to provide an effective learning [12] about the C++ programming basics and programming constructs for the students that have no prior knowledge of any programming language and have less or very basic information about the usage of information and communication technologies.

The proposed model is the individualized self-paced eLearning online model build using rapid e-Learning prototyping as an instructional model [15].

II. LITERATURE SURVEY

2.1 e-Learning

eLearning has been described as the integration of information and communication technologies , typically computers and a network access (either internet or intranet), to support education. It incorporates all educational activities that are carried out by individuals or groups working online or offline or synchronously or asynchronously. These various types of eLearning activities are discussed briefly below [9].

2.1.1 Individualized Self-Paced eLearning Online

It refers to the activity when an individual learner is accessing the resource such as database content or a static content via internet or intranet. Examples include a learner conducting some research online, an individual studying basics of programming alone.

2.1.2 Individualized Self-Paced eLearning Offline

It is the situation when a learner is using some learning resource to study without the need for accessing internet or

intranet. Examples include the use of DVD-ROMs and CD-ROMs.

2.1.3 Group based eLearning Asynchronously

The activity when groups of learners are working together over an internet or an intranet. Time delays are involved in communication among various participants as the communication occurs with the help of emails (posts) or text board messaging within a learning management system.

2.1.4 Group based eLearning Synchronously

The group of learners is working together in a real time via an intranet or an internet. It may include text board conferencing and one way or two way audio or video conferencing.

2.2.1 Characteristics of Effective eLearning

An effective eLearning satisfies some certain characteristics [10]. Some of them are:

- Learning Objective is successfully reached
- Access is easy
- Easy to use
- Consistent and Accurate message
- Memorable
- Relevant
- Reduced Training Cost

The combine effect of these characteristics within an eLearning system motivates the learner and helps him to understand the concepts, techniques and issues addressed in the course.

2.2.2 Components of Effective eLearning

eLearning course is usually for a wide variety of users. So, a special emphasis must be on content to be delivered and a way to determine about the learning of the user after delivery of one content is finished. Moreover, the participation of the users increases feedback for the system as well. Three components of an effective eLearning system have been identified as [2].

- *Content*

All the material and instructions to be delivered is included in the content. It comprises of list of tasks to be performed to complete an activity, manuals and technical document about a system, graphical aids like flowcharts, hierarchical charts, figures, simple text written along with the involvement of multimedia programs like video, audio, power point / flash presentation etc.

- *Experience Activities*

Such types of activities are designed to enforce the interest and the involvement of the user in the eLearning environment. Examples include games, simulated activities or some exercises that serve the purpose of learning either directly or indirectly.

- *Feedback Activities*

The basic purpose of such activities is to evaluate the understanding of the users either directly or indirectly. This may include simulated games, quiz structure or exercises to help users to check their learning and repeat the content if desired.

III. DESCRIPTION OF THE COURSE

3.1 Motivation

Programming in C++ is taught to the undergraduate students of chemical engineering and technology so that they can think logically, could have better understanding of algorithms so that they can solve large problems by dividing them into smaller ones and most importantly their might need to program on jobs as well.

But the problem lies in the fact that most of the students either belong to rural areas where computer and other technology enabled devices are hardly available or they have a very little knowledge about the current computer technology. The worst of all, most of the students are shy to ask about what they did not understand during the class lecture.

So, there is a need for the improved and easy to use tool that could teach help them to learn computing and programming effectively.

3.2 Educational Objectives

The educational objective of this eLearning system is to deliver the contents of the programming in C++ course and an interactive help system online so that the learning process of students is not stopped in the absence or unavailability of the teacher.

3.3 Proposed System Overview

The proposed eLearning system is a simple and easy to use web-based navigational application to facilitate the users having very less knowledge about computers.
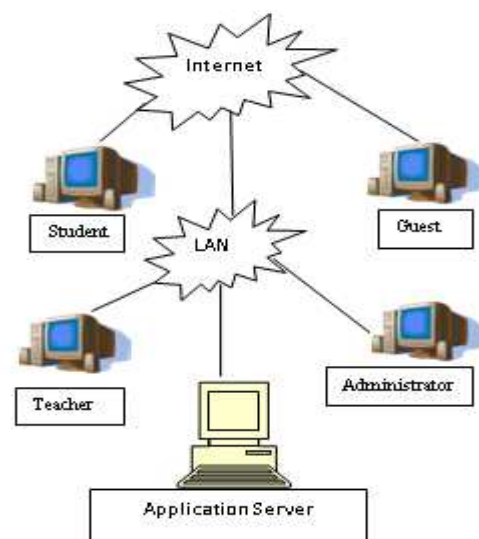

Fig. 1: Proposed System Overview

The proposed system is built in joomla, an open source content management system that contains PHP and MySql as an integrated part. So the greatest advantage is that we do not need to install a separate database server.

3.3.1 User Management System

The user management system is divided into four main categories to distinguish between the concerns of the users. They are:

Fig. 2: User Management System Interface

- *Administrator*

Administrator manages the entire database activities and information of the eLearning system. Its major responsibilities are to update any data requested by the teachers and students, activate and inactivate the registration of the user along with the user accounts management when activated.

- *Teachers/Mentors*

Teachers are the one who are directly involved in the delivery and management of the contents of the eLearning course. Teachers can upload class lectures, hints to solve assignments, quiz results, multimedia presentations and final assessment of the course.

- *Students*

Students are the primary consumers of the course. They review literature, upload assignments, take online quiz for preparation along with the facility to take an online course offered by the eLearning system.

- *Guest*

Guests are those who are not students of the university but are interested in taking the online course offered by the university. For such persons, only the online course for teaching computing and C++ is activated by the administrator.

3.3.2 An online C++ Compiler Installation Assistance

An online assistance for installing C++ on the computer is available for the students and the guest with installation snapshots for the convenience of the user.

Fig. 3: Compiler Installation Assistance Interface

3.3.3 An online Syntax Error Help Assistance

Online basic syntax help assistance is also available for the beginners indicating the syntax error along with the solution to remove it.

Fig. 4: Snapshot of the Syntax Error

3.3.4 An online eLearning system for Computing and Programming

The online course for teaching computing and programming is divided into five phases.

- *First Phase*

The first phase includes the introduction of the basics terms and concepts of a programming language and the computer system.

- *Second Phase*

The second phase includes the introduction of the simple programming constructs used in the programming language and their practical implementation along with examples and exercises.

- *Third Phase*

The third phase includes the introduction and implementation of decision and repetition structures in the C++ programming language.

- *Fourth Phase*

The introduction to pointers and its implementation will be covered here in this section.

- *Fifth Phase*

The fifth phase includes the introduction and implementation of composed data   types along with examples and exercises

3.3.5. Detailed Plan

This plan starts by exposing the students to the introductory level knowledge about the computer , software, hardware, working of computer system, operating systems, programming languages, types of programming languages, importance of programming languages, translators, types of translators and their differences, differences between different programming languages. This initial level of our plan will serve for the development of basic prerequisite required by the C++ programming.

After the completion of the first phase, the basic concepts about C++ programming will be delivered. This part will include teaching students the concepts of algorithms, pseudocode, header files, compilation, IDE demonstration, variables, constants and basic input output related functionalities along with the use of arithmetic and logical, relational operators.

The third phase will focus on the learning of the decision support structures and their applications along with the repetitive structures and their applications. The use of these two important building blocks of programming languages is further practiced by solving real world small scenario problems.

The fourth phase involves the instructions and important learning concepts about pointers and their implementation.

The fifth and the final phase include the learning of composed data types, arrays, structures, unions and classes.
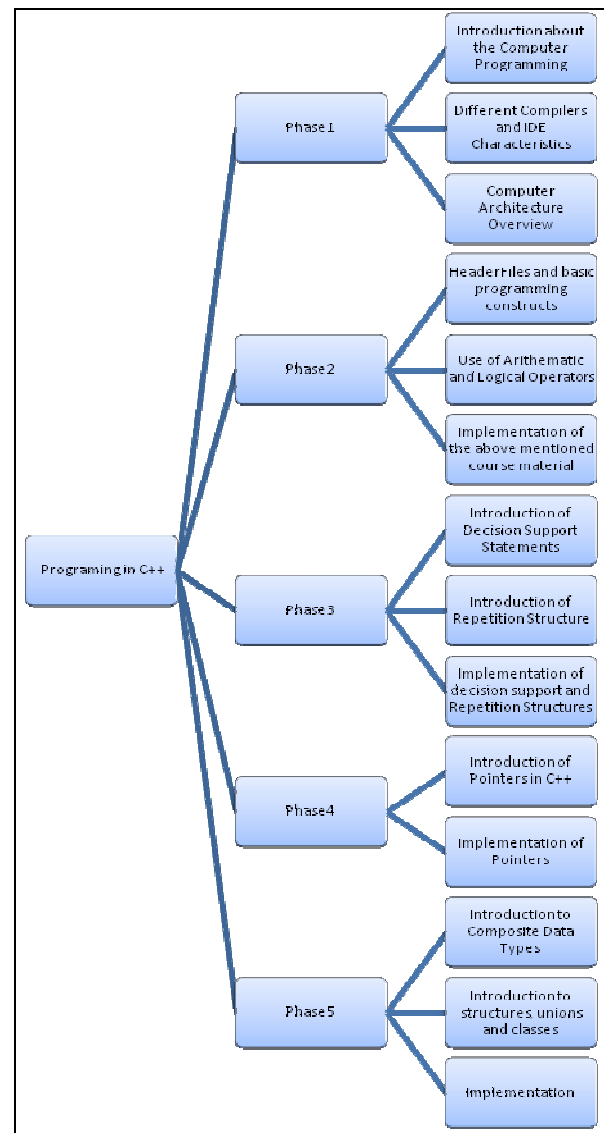

Fig. 5: Detailed Plan of the System

The learning is experienced by exercising their applications and solving problems.

IV. CONCLUSIONS

The proposed eLearning model is an interactive model for teaching C++ programming in a hybrid (classroom and online) system for the students of the university and an asynchronous online model for the users who want to get the initial background of the C++ programming. The system is easy to use and can be accessed any time.

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