

‘C’ E-Learning System to Find Learning Statistics

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ABSTRACT

The E-Learning System is a web based system that focuses on the use of graphical simulation to help students learn the basic concepts of programming easily. The intended project would be used by the students as a web based tutorial for practicing programming. Currently, students who are new to programming find it difficult to understand how exactly programming works. This makes learning the subject even more difficult. The proposed system aims to help students develop aptitude towards programming with the help of graphical simulations. The system also intends to classify the students on the basis of their level of competency and programming and devise various strategies for various competency groups.

Keywords— Graphical Simulations, Programming, E-Learning System

I. INTRODUCTION

Education is the most primary aspect of an evolving society. The quality of information and knowledge that can be generated by the society depends a lot on the level of education imparted to the citizens. So it is very important to maintain the quality of education.

Traditionally, education has been imparted to people in classrooms where one person teaches many people in a closed environment. This kind of restrictive environment though educating people in a disciplined way is not always conducive for all types of learners. It is not possible for all types of learners to learn effectively in the classroom scenario. In this case, these people prefer to learn by themselves. Again, their levels of aptitude may be highly varied. So the kind of the of knowledge that they need to learn properly is also different.

Highly concept based subjects like mathematics and programming are difficult to understand directly when taught theoretically. The concepts that drive these subjects are difficult to grasp. And that is why people have turned towards e-learning systems to try explaining the basic concepts to novices better. It has been observed that students using these types of systems learn concepts better because of

the freedom and flexibility available to them in terms of timing and speed of progress.

Computer programming is one such subject that is taken up apprehensively because people do not understand the basic concepts and internal workings of the programming constructs. Many a times, students try to learn the codes by heart and reproduce them in examinations. Instead of that, if the students understood the workings of each steps then they might be able to develop their logical skills and then move on to complex programs.

Keeping that in mind, an E-Learning system has been proposed that uses graphical simulations to explain the concepts of programming. The visual depictions help students understand programming better.

It has been observed that if students could understand the basic concepts of the internal workings of execution of programs then they can comprehensively understand the basics of the subject and then easily apply them in more involved programs. In regards with these observations, the E-Learning System has been proposed. The E-Learning System aims to help students learn programming and understand its basic concepts by the help of graphical simulations and classifying the students according to their competency.

The three main principles of E-learning systems are: Design, Implementation and Proper Assessment. The conventional websites (like w3schools, tutorials point) lack the two-way communication that facilitate and elucidate the concepts. An effective E-Learning System should have a considerable degree of automated evaluation. The contents should be mobile accessible and downloadable in PDF formats. E-Learning should use gamification (game mechanics) to increase engagement levels.

II. PROBLEM DEFINITION

When students are introduced to programming, they find the basic concepts difficult to grasp. That is because programming is a highly logical science. It is similar to mathematics, in a way. For example, it takes more efforts for very young students to understand basic arithmetic than it takes more experienced students to

understand advanced mathematics. If the basics of programming are not cleared up for students in the beginning they have major problems understanding advanced programming. So a system needs to be developed that makes use of modern techniques to expound basic programming concepts to students new to programming. They need to be able to understand their errors better and rectify them efficiently.

III. LITERATURE SURVEY

Student Modelling in an Intelligent Tutoring System for Passive Voice of English^[5] Developed by - Maria Virvou is an intelligent multimedia tutoring system for the passive voice of the English grammar. The system may be used to present theoretical issues about the passive voice and to provide exercises that the student may solve. The main focus of the tutor is on the student's error diagnosis process, which is performed by the student modelling component. When the student types the solution to an exercise, the system examines the correctness of the answer. If the student's answer has been erroneous it attempts to diagnose the underlying misconception of the mistake. In order to provide individualized help, the system holds a profile for every student, the long term student model. The student's progress and his/her usual mistakes are recorded to this long term student model. This kind of information is used for the individualized error diagnosis of the student in subsequent sessions. In addition, the information stored about the student can also be used for the resolution of an arising ambiguity, as to what the underlying cause of a student error has been.

Intelligent Tutoring System for Students Learning to Program in C++^[6] developed by – Samy S. Abu Naser is an intelligent tutoring system to teach students C++ programming. It is a simple application where students enter a program and the system generates information if the program was correct or incorrect and the explanation for the mistakes. The project assumes that information presented to the user highlighting his errors will better enable the student to learn from his mistakes and thus get better at programming.

Adobe Captivate Prime developed by Adobe, it has features like intuitive dashboard to keep tracks of pending and completed task and offline availability and mobile friendly^[1].

TheAcademy LMS developed by Growth Engineering, it has features like intuitive learner dashboard and gamification(game mechanics) to increase the engagement of learners^[2].

ExpertusONE has features like reporting tools, graphical representation and built in conferencing with other users^[3].

Moodle provides detailed guidelines, discussion forum and a download section^[4].

IV. PROPOSED WORK

A web based E-Learning system has been proposed to be developed for teaching basic programming with the following modules:

4.1 Registration Module: This module enables new users to register to the system with user specific user ID and password which will be stored in the database.

4.2 Login Module: This module enables the user to login to the system using the respective user ID and password. In case of wrong credentials, the user won't be given access else will be directed to the homepage.

4.3 Text Editor: This module enables the user to write code with features like predictive text and submit it to server for further analysis.

4.4 Compiler: This module receives the code from the text editor and compiles the code to generate an output. For the online compilation of program API will be used.

4.5 Output Window: This module works in tandem with the compiler to generate an output of the code provided by the user. This window will be present as a tabbed pull able drawer in the interface and will be implemented in the front end using ReactJS. The output will be generated from the JSON file sent by the API call.

Information Module: This module will contain theoretical explanation of programming concepts which could be used by the user.

4.6 Learning curve generator: This is the main module which we have developed to deal with the learning part of the system. This module is responsible for checking that each student is learning the subject or not. For that it collects data from the usage of the user and uses it to determine his level of learning. This is a continuous process and thus the student level is constantly monitored. Following are the factors that are considered while calculating the level:

- Number of errors in the code
- Responses to quizzes

The level is calculated as a score that is dynamic, that is, the level keeps on changing because of the above two factors. And this level determines how much the student has learned. Following are the rules that affect the level calculation.

- Depending on the severity of the error, 10, 20 or 30 points are deducted from the level.
- The score of the quiz answered, which is out of 100, is added to the level.
- If the student answers the program incorrectly, he can keep on attempting it. However, the deductions of the previous attempt are overwritten. When finally the student attempts the program perfectly, he is awarded 50 points and his further attempts to the same question are not considered in the level calculation.
- Similar scoring policy for multiple attempts at a quiz is followed.

The graph generation will be done using JavaScript library ChartJS. The flowchart described in fig. 1 explains the process used to generate the learning curve.

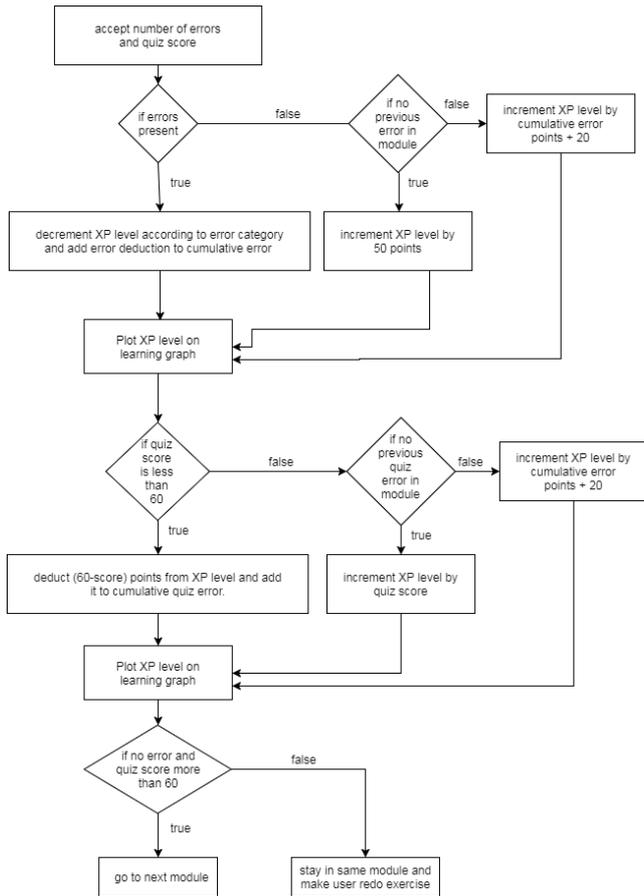


Fig. 2: flowchart of learning curve generating module

4.7 Comparison with others for percentile: Comparison to similar learners helps the learner as well as the system to discern the learning level of the person. We have developed an algorithm that compares various users by comparing their learning level at corresponding instances of time. This method requires the system to memorize learning levels of each user at each point of time. So a user's performance after completing a certain module will be compared with the performance of all other users after they had completed that particular module. Based on the grade points of the current time the percentile rank of the student is calculated and the student is classified according to these rules.

- Top five percentile : Experts
- 80 to 95 percentile : Pros
- 50 to 79 : Intermediate
- Below 50 : Beginners

The calculation of the values will be done in basic PHP.

4.8 Adaptive questionnaire: The proposed system is using results from coding as well as answers to quizzes to determine the learning level. In order to increase the accuracy and determine in-depth learning of the user we have developed an adaptive questionnaire algorithm. The quizzes posed to the user will cover questions on the main domains of programming; theory, debugging and predict the output. As the user starts attempting various quizzes the results from quiz of previous module will be used to design the quiz of the next module. Depending on the performance of the user

in individual sections the amount of questions on that domain will change relative to others in the next module.

1) Store the number of errors in each domain.

2) Calculate error percentage as follows:

$$\frac{\text{Number of errors}}{\text{questions answered in the domain}} \times 100 \quad (1)$$

3) Find the domain with the maximum number of error percentage.

4) Reallocate 2 questions from other domains to this domain.

This will ensure that the user improves his performance in all domains of programming.

4.9 Simulation Window: It will display and generate graphical simulations based on the programs typed by the user which will help explain the concepts used in the program to the user.

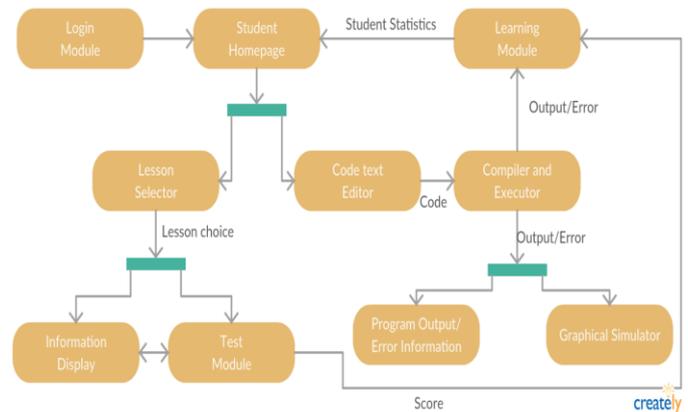


fig 2: System Flow

V. EXPECTED RESULTS

The proposed project is expected to generate accurate graphical simulations for the users based on the programming constructs that they provide. The number of errors that the student does and the proficiency in quizzes is used for an aptitude evaluator which will help classify the students into various groups.

VI. CONCLUSION

In the project, to design and implement a low-cost and user-friendly website using web technologies namely HTML, CSS, PHP, WebGL and JQuery. The target or goal was to provide students or anyone who is interested in learning C programming language, a website through which a user can easily understand the concepts of C language and Data Structures. In order to make the learning interactive it was necessary to implement a simulated environment. This will make the entire session more fruitful for the user and the overall experience will be less time consuming. There is still scope for future development in this system and use this concept with a broader approach. Finally, the system will be helping the users to learn the C programming language concepts in a fun way with the help of animations so user will be able to learn how to code. For this all the concepts right from the basics like data types and keywords to If...Else statements and switch case to all loops and the

basics of data structures are included. It is hoped that the system can be used by many educational institutes and organizations so that the students or fresher's can take the most advantage of this system.

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