



Automatic Web Based Evaluator of Programming Assignments- A Review

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Abstract

The popularity of computer science courses is increasing day-by-day. As a result, number of students enrolling in this course also increasing. The faculties assign different types of assignments related to programming intensify the results of the students, but the evaluation process is not straight-forward. Assignment Evaluation became a burden for instructors. This consumes much time for steps like compiling and testing programs with different inputs. This project introduces an online assignment submission and automatic evaluation web platform for those assignments. It can easily create and rapidly evaluate student assignments, with lower error rate. The Submit application is capable of creating courses, managing enrolled students, creating assignments and their test cases and automatic grading of student's submission. The graders are able to view and grade the submission and able add the comments. This can be developed by using different web-based technologies like Html, JavaScript, PHP.

Key Words: Automatic Evaluation, Lower error rate, JavaScript, PHP, Grading, Test Cases

Introduction

Now a days, many students are enrolling in computer-based courses. In these courses they will learn the languages like C, C++, Java, Python etc. To improve their skills in these languages students must attempt the assignments on daily basis. The web evaluator, which is designed through this project is used for evaluating these programming assignments automatically. The ability of users to program is tested and graded using a variety of tools and web applications. But there isn't yet a tool available online for evaluating Scala programming issues. The fixed set of programming issues in the current program's is one of their drawbacks. Compiling the solutions and testing them against the various inputs requires time-consuming steps. Programmers learning programming languages

can benefit from a web-based automatic grader. Users are given the opportunity to add their own programming tasks to the existing issue set. Instant feedback is given to users on their responses. A user is motivated to try again and again until he comes up with the right solution even if he doesn't succeed on the first try thanks to accurate and thorough feedback. This improves programming skills of the programmer and their interest in solving more number of problem statements.

Literature Survey

The system that was designed to make it easier for instructors to evaluate programming assignments is the subject of this paper, which is a part of the project. This is about a simple tool that helps to



solve more problems on programming assignments easily. It reused the course management functionality from the Moodle system that is already in place. It has also examined the student responses to assess how well the system is being used. The Moodle tool is the primary topic of this paper. Thanks to this, teachers can easily create their own questions. The Moodle is can generate the detail report on the student's performance. It also executes java programs effectively. The main drawback is the students must use their own IDE to execute the programs. There are no inbuilt compilers.[1]

The 2TSW system, which employs a test-based methodology in a web context, is described in this article. Students may access assignment checklists in 2TSW and submit, test, and score their own solutions. It's an instructional setting that makes use of a few different gaming mechanics and game design concepts. For instance, levels, leaderboards, events, and accomplishments. In this system, results are declared with some medals by student performance in the tasks. This paper aims at increasing motivation learning of course and improving student skills. Providing a competitive environment will make student to work hard and score well than their peers. This gamification method will attract the students feel this system interactive and interesting. This paper also includes plagiarism check for the codes so that mal-practicing will be avoided.

In this paper a technique was introduced which boosts up the skills of a learner to learn and solve mor number of programming assignments. It includes a dashboard which consists of a profile of the student and his progress and grades. The badges will be allocated to the solvers according to their performances.

Finally, analysis of the students who attempted or not attempted the problem statements will be provided to the instructors. They can download the scorecards of the learners who have access to the websites.

The student and the teacher have access to varying degrees of student information via the dashboard, based on their rights. . Teachers may get a full presentation of each answer, however students can only receive the most basic information about another student. [2]

This paper describes an automated web-based

system for grading Java assignments and provides reports on the assessment outcomes for a real programming course. This system receives student-submitted Java application programs as input, and it promptly delivers the assignment results. Compiler verification, JUnit testing, and result verification make up the assessment approaches. The kids can greatly advance their coding abilities thanks to this. By submitting their programs numerous more times, many students caught their errors and made corrections. The MVC architecture of Struts serves as the system's foundation. As a model, the MySQL DB holds data about students and assignments. The student-submitted programs are received by the server, evaluated, and grades are assigned. This system was used to describe how many students used the system, what kind of problems in them are unsolved, so they can improve themselves. There is not applicable to other programming languages except JAVA.[3]

The TF-IDF and cosine similarity algorithms were combined by the author of this research to create an automated assessment system. The connection between students and instructors is simpler on the e-assessment platform than it is during traditional learning, according to the author, who recognized the value of it. The issue with e-learning platforms, according to the author, is that it takes a long time and is ineffective for the teacher to review a large number of evaluations. So the author proposed an architecture where he uses TF-IDF and cosine similarity.

Using TF-IDF he tokenizes all possible words, filter the un-necessary words and finally a matrix which is called submission matrix will be generated. To evaluate the effectiveness of the approach, the author employed 105 submitted programs. Among them, 63% of the programs were correctly scored like experts, and 33% were incorrectly graded. Given that the entire evaluation process was carried out by computer, this kind of evaluation is quite effective. Compared to other ML techniques, TF-IDF was extremely quick. To evaluate the effectiveness of the approach, the author employed 105 submitted programs. By using this algorithm, 33% programs were mis-graded. [4]

The author developed an web based interface called submit! Which provide student's feedback about the program they write. By providing the feedback students will make use of this system and develop to do better in assignments. The author



developed an automated critiquing tool which allows the students to get a critical feedback for the assignment before final submission. Traditionally critiquing was done manually for student to student manually. Lecturers general study the work, run the program, test with a manual data and make comments according to their work. When it comes to for a large number of students traditional methods will fail as it will be time consuming and inefficient. So author made a programming critique tool which will provide feedback on the submission. The major objectives of Submit! Project are:

- (i) To create a set of tools that are especially designed to facilitate program criticism;
- (ii) To give each tool used in the project a consistent user interface.
- (iii) Making sure that usability must be considered in the design of the tools.

The main overview of the project is the construction of an automatic evaluation system for computer programs, which is implemented in selected computing units, and the evaluation of the effectiveness of the system.

It is a user-friendly system for students that identified the strengths and weaknesses of students and was able to determine the level of intuition. The assessment process consists of heuristic assessment, observation and questioning of students taking the predetermined tests. Submit! Project was Integrated to many universities as this tool works perfectly for the student feedback. Using comments students will get to know about their performance and improve at the areas where needed. Sometimes critiques may not be relevant as these are done automatically by the system. [5] This paper illustrates a technique to assess the student's programming skills. The important benefits that offered by this system are: immediate feedback, consistency of the evaluation of the assignments. This paper had introduced CS2 programming tools course. It also shows how Mooshak can be used to help in the evaluation process of a programming task. This article contains a tutorial on programming tools. PT includes two distinct parts: the first is a theoretical part that deals with testing, debugging, and program and administration. Second part is practical part. Plagiarism detection and program testing are the main methodologies included in this paper. This makes the evaluating the programming assignments automatic. Generate the grades

automatically and instructor can download them. The purpose of this paper is to compare the effects of an automated rating system and face-to-face rating. By using this student can perform tasks like Testing, Debugging, Deployment, Versioning. It promotes student ability to learn programming tools by gaining knowledge.[6]

Drop project mainly concentrated on points like increasing no. of enrolled students year over year which results on getting grading process harder and consumes more time. The main criteria of this project is submission flexibility. In this teacher can create assignments. Some plugins are required additional files so that they can reduce the possible errors. The task is stored in a Git repository to which DP is connected using standard access keys. Any changes made can be updated with a simple update button. This application is primarily developed using Kotlin and uses the Spring Boot framework. The software functionalities used in this application are standard assignment format, Individual and group submissions, Programming languages, cool-off period, Access-control lists, Test matrix, Mark submission as final, Rebuild submission. This application has a method that is report of submission which generates a page consists of project structure, code quality, compilation, student unit tests and teacher unit tests which is in the perspective of the student. It's architecture is based on MVC architecture. JacocoResultsParser handles parsing student test results, and Junit Test manages the results of each submission. This program's report includes information on how many hidden test cases were completed and how much the student's own tests achieved with the code. In this application, they presented DP, an open-source AAT with a wide range of functions that can support complex. This tool reduces the evaluation effort. Improve grading consistency and increase project difficulty. This allows teachers to understand student problems and reduce their workload. The grading process has become more efficient and consistent across teachers. Finally, it asks for student's feedback to know about the difficulties of students faced during solving the problems. The drawbacks of this project can be eliminated by increasing the range of projects that can be done with this application, and DP can use more languages. The goal is to increase the level of student feedback and optimizes the professor's time.[7]

Examines a number of establishes and recent technologies for automatically grading of



programming assignments obtaining and displaying important data. There will be a comparison and analysis presented to determine the state of the industry now. Then a characterization of the grading metrics is suggested. The Final part includes recommendations for further development. The primary objective of creating or utilizing these kinds of tools is to increase programming abilities in the pupils, devoting particular attention to those who are beginners. Solving problems will help you develop your talents. Various exercises in programming. The students can advance to other tasks as soon as they perform well feedback They might learn from their errors and develop their abilities with its assistance. A large number of students attend regular engineering classes, and there are a significant exercise in programming, manual grading is not practical. coding language that was used to create the tool When an institution has a set of policies regarding the software it uses, this feature is extremely important. It would be a useful feature to be able to select a tool for modification or maintenance. Logical structure When a tool is being modified, it is a crucial feature. This architecture will demonstrate the degree of flexibility, scalability, and modularity. It demonstrates the workings of the tool's hardware. It is beneficial to determine if a given environment will permit the use of a tool. The worst-case scenario will provide information on the resources required, which will help determine how much an implementation. The Scalability, maintainability, and security are seen as the key benefits. The provided Java and C++ are the programming languages used for grading, and Java was used in its development.[8]

This paper presents the design and implementation of an automatic evaluation system for university programming functions. The main task of counterfeiting is to detect whether the presented software is a stolen copy. Software testing is performed by running a series of test cases on the subject software, which can be generated manually or automatically. Longest Common Sequential (LCS) algorithm. This LCS-based detector attempts to detect plagiarism in short programs such as programming tasks. For all algorithms, we assume that p1 and p2 are the two programs to be compared, ignore all identifiers, and use the number of characters, words, and lines as metrics to detect plagiarism. Calculate and compare the flowcharts (graphs) corresponding to

programs p1 and p2. The similarity index is calculated by running the longest common suffix (LCS) algorithm with the programs P1 and P2 as inputs, treating the program as a sequence and the words {id, keyword, special symbol} as characters of the sequence. The LCS algorithm computes a graph that again makes one pass, i.e. linear time. The time complexity of LCS using dynamic programming is $O(m * n)$, where m and n are the number of words in programs P1 and P2. The problem is limited to generating test cases. Depending on the method chosen, there are two main categories: manual and automatic. In automatic test case creation, when the author (teacher) submits a programming problem with its model solution, it is taken offline. After automatically

creating the test case, actual comparison of the automatic test case output with the software presented in online mode is done. [9]

Programming of the presentation and evaluation system (PASS) It was developed for collaborative use by the students and staff. PASS is used to provide C programming tasks, mainly using PHP / MYSQL to develop server-side functions and front-end technologies such as: HTML / JavaScript to develop interfaces that interact with users. PASS IDEONE makes use of the API most effective for the compilation method the usage of the SOAP protocol. For developing and compiling pupil code, offerings along with IDEONE.com provide online compilation and debugging offerings. IDEONE is used to offer preferred input and may be taken into consideration as a actual interactive input. Simple Object Access Protocol (SOAP) is a protocol specification for replacing dependent information while imposing net offerings. It makes use of XML Information Set for its message format, and is based on different utility layer protocols often via way of means of HTTP. IDEONE makes use of SOAP specification for having access to the methods. PASS calls for every pupil to login with their Student credentials via way of means of the usage of those credentials are given to the pupil upon registration for his or her program of take a look at which will use IDEONE compiler, college students are required to check in on IDEONE to achieve API credential get admission to which later could be utilized in PASS to call the API compilation/debugging methods. PASS has been advanced primarily based totally the usage of Object-Oriented Programming (OOPS) approach, according to the author in this paperwork.[10]



RELATED WORK

An automatic grader that may be used online is helpful for programmers learning programming languages. It enables users to add their own programming exercises to the current collection of issues. Users immediately receive feedback on their responses. Even if a user is unable to solve an issue on the first try, precise and thorough feedback motivates him to try again and again until he finds the right answer.

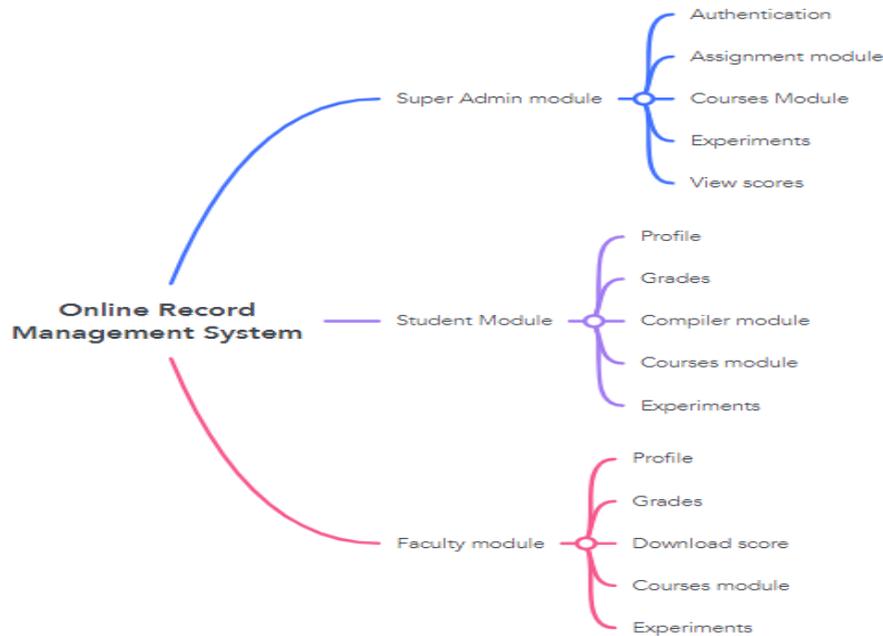


Fig.1: Mind map of modules

COMPARISION TABLE

Title of the paper	Methodology	Merits	Demerits
Automatic grading of programming assignments: an approach based on formal semantics.[1]	1. Labrat and WebLabrat are used for java grading and a web interface. 2. Enhances for Labrat Javabrat is used and a Moodle plugin is used to facilitate instructors to grade the Scala assignments.	The Moodle is can generate the detail report on the student's performance. It also executes java programmes effectively.	The main drawback is the students must use their own IDE to execute the program. There are no inbuilt compilers.
2tsw: Automated assessment of computer programming assignments, in a gamified web-based system.[2]	1. The programming assignments in this case are tested using the 2TSW system. 2. Gamification technique is used to design gameplay features.	Providing a competitive environment will make student to work hard and score well than their peers. This gamification method will attract the students feel this system interactive and interesting. This paper also includes plagiarism check for the codes so that mal-practicing will be avoided.	The student and the instructor can access different levels of student information through the dashboard, based on their access rights. Teachers have access to a full presentation of each answer, however students can only obtain basic information about another student.
Design and evaluation of automated scoring Java programming assignments.[3]	1. Compiler Check perform the checking of testcases. 2. Junit test and result test are used to assess the programming outputs and improve the students programming skills by providing the repeated submissions through the compiler.	This system was used to describe how many students used the system, what kind of problems in them are unsolved, so they can improve themselves	There is not applicable to other programming languages except JAVA.



Automatic evaluation of programming assignments using information retrieval techniques.[4]	Checking for plagiarism is done using TF-IDF. Another method for creating an e-platform for the automatic evaluation of programming assignments is cosine similarity.	This is very efficient way of evaluation as the whole evaluation was done by computer itself. TF-IDF was a very fast. ML algorithm than any other ML algorithms.	To evaluate the effectiveness of the approach, the author employed 105 submitted programs. This method led to 33% of programs receiving incorrect grades.
Submit! a web-based system for automatic program critiquing.[5]	A web-interface called submit is used to provide the feedback students will make use of this system.	Submit! Project was Integrated to many universities as this tool works perfectly for the student feedback. Using comments students will get to know about their performance and improve at the areas where needed.	Sometimes critiques may not be relevant as these are done automatically by the system.
Automated evaluation of programming assignments.[6]	Plagiarism detection and program testing are the main methodologies included in this paper.	This makes the evaluating the programming assignments automatic. Generate the grades automatically and instructor can download them.	The limitation is can include methodologies like gamification to create more interest in solving problems.
Drop Project: An automatic assessment tool for programming assignments.[7]	A DP, an open-source AAT with a variety of capabilities, is presented in this study.	The evaluation effort is lightened by this technology. Increases the project's difficulty and enhances grading uniformity.	The drawback of this project is that only a few projects can manage it, and only a few languages can be utilized with DP.
Programming assignments automatic grading: review of tools and implementations.[8]	This review paper consists of many tools and implementations for programming assignments for automatic grading.	This paper focuses mainly on beginner students. Plagiarism is the important module inside this paper.	The main disadvantage of this paper is many tools are used for performing several functionalities.
Automated assessment in a programming tools course.[9]	In this case, Mooshak is utilized to assess the issues and support the evaluation of the student's responses.	The benefits of this system are: immediate feedback, objectivity and consistency of the evaluation.	Lack of a proper sample size calculation, which affected the results, is the main restriction.
PASS—A programming assignment submission system.[10]	1. In this paper the PASS components are used to submit the assignments. 2. Developed mostly using PHP for the server side and HTML/JavaScript for the front end.	It benefits both the and instructors. Reduces evaluation and time management problems.	There is no plagiarism checker included.

Conclusion and Future Scope

Finally, we draw the conclusion that our approach of assessment frees instructors from having to manually grade student-submitted programs in a course that is program-based. By receiving immediate feedback about the assignment results and rankings based on student performance in the task, this is very beneficial to students in helping them improve their programming skills. It also helps students make better overall progress because the detailed feedback encourages him to try the problem again until he finds the right answer. By submitting their programs again and again, many students caught their errors and fixed them. This project's cap of 50 submissions is one restriction. By purchasing subscriptions based on our needs and the number of pupils, this may be enhanced.

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Conflict of Interest

None.

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