

Cloud-based Application to Leverage the Coding in Education Institutions

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Abstract

During these hard times due to the widespread of COVID-19 all around the globe, everyone, including both teachers and students are forced to give and take education virtually, and most of them face issues of unavailability of mediums such as devices and space to store, manage and organize academic-related stuff, so to meet these insufficiencies our virtual coding platform provides a simple and efficient way to store, manage, organize and create all the practical related documents and files at a single place. Teachers can easily create classes and invite students, assign them tasks & coding assignments all in a single place, and evaluate each student based on the work that they have done. This platform eliminates the need of installing language-specific environments in their machines by providing an online IDE that supports many programming languages.

Keywords

Virtual coding platform, online IDE, programming languages, language-specific environments, practical.

1. Introduction

Teaching online is at the forefront of every college professor's mind nowadays. For those of us who teach computer science, and take programming classes, we're very much used to the energy and excitement of physical lab environments. Obviously, during current pandemic times, it's impossible for us to get together in these tightly packed physical spaces to hold lab classes. It is also difficult to maintain all student assignment works and notes related to lab class in one place. Students have to use many applications to do different tasks that create a mess. Finding a single specific platform that can help teachers and students to create, manage and complete assignments online with all required tools in one place is difficult. This covers all the problems that can be solved using this project.

The Virtual Coding Platform for programming classes is a great advantage for teachers and students all around the globe to manage the programming assignment all on a single platform. A platform where teacher and student will be able to join the same classroom to perform programming practicals where students will have a functionality-rich online code compiler and editor to complete the coding assignment. It will help the student to keep all their work in a single place.

Students and Teachers will get the innovative and interactive platform to create, manage, complete and evaluate programming assignments online. Students and Teachers will have a room where they will be able to store all lab related or assignment specific notes and material all at a single place. All this will be maintained in a real time environment.

1.1 Objectives

- To virtualize the physical coding lab environments.
- Archive and manage the work of students in one place.
- To minimize the need for powerful hardware from the client-side.
- To eliminate the need to download compilers and softwares for every programming language on the local machine.

- To allow teachers to have automated checking and evaluation of the students' coding assignments in an organized manner.
- To provide an online code editor which supports many programming languages along with syntax highlighting, auto complete and user-friendly interface.
- To reduce the task of creating testcases for commonly used coding problems and algorithms.

2. Literature Review

Existing Systems: The following are the observations based on our review of the existing systems:

HackerRank: HackerRank is a coding platform that enables programmers from all over the world to solve coding challenges. Hacker Rank supports a variety of programming languages (including Java, C++, PHP) and spans over a variety of computer science domains. When a programmer submits a solution to a programming challenge, the submission is scored based on the accuracy of the output. Programmers are then ranked globally on the HackerRank leaderboard. In addition to individual programming challenges, HackerRank also hosts contests (often referred to by HackerRank as "Code Sprints") where programmers compete on a specific set of programming challenges during a short period of time and are then ranked at the conclusion of the event. Hacker Rank also allows companies to recruit programmers based on their performance. Hacker Rank is seen as a market leader in the growing gamification trend within competitive computer programming and the consumer-side of its website is free for coders to use.

CodeChef: It is a global competitive programming platform that supports over 50 programming languages and has a large community of programmers that helps students and other computer professionals test and improve their coding skills. Its objective is to provide a platform for practice, competition, and improvement for both students and professional software developers. CodeChef conducts regular practice contests for ACM-ICPC and also conducts monthly contests to give away prizes. Apart from this, Interactive Coding Platform for Students 296 Published By: Blue Eyes Intelligence Engineering & Sciences Publication Retrieval Number: E1980017519 it aims to reach out to students while they are young and inculcate a culture of programming in India.

E-Box: E-Box is a Technology Enabled Active Learning and Assessment platform for technology and engineering domains. Apart from the basic LMS components like quizzes, assignments, lesson components, resource components etc. It has numerous activity components pertaining to technology and engineering concepts that could be used for design and analysis-oriented learning. These components are also used for assessing the design and analysis skills of candidates apart from the regular knowledge level testing.

Google Classroom: It is a free blended learning platform developed by Google for educational institutions that aim to simplify creating, distributing, and grading assignments. The primary purpose of Google Classroom is to streamline the process of sharing files between teachers and students. As of 2021, approximately 150 million users use Google Classroom. Google Classroom integrates a variety of other Google Applications for Education, such as Google Docs, Google Sheets, Google Slides, Gmail, and Google Calendar into a cohesive platform to manage student and teacher communication. Students can be invited to join a class through a private "class code" or be imported automatically from a school domain. Teachers can create, distribute and mark assignments all within the Google domain. Each class creates a separate folder in the respective user's Google Drive, where the student can submit work to be graded by a teacher. Assignments and due dates are added to Google Calendar, where each assignment can belong to a category or topic. Teachers can monitor each student's progress by reviewing the revision history of a document, and after being graded, teachers can return work along with comments and grades.

Findings: Flipped Learning (with or without technology):

The flipped learning approach transforms the classroom into an interactive platform where information is transformed into knowledge and experience. Students have an opportunity to participate actively in the course and to transform the information into knowledge in a process facilitated by the instructor. That is to say, while the student is taught in the traditional teaching method, s/he learns in this approach. This active learning approach is expected to be positively reflected in extra-curricular activities. The aim is to enable students to receive an education that prioritizes their entrepreneurial, innovative thinking and creativity skills. To achieve this purpose, digital technologies, which increasingly affect all areas of our life, are also used in the planning and execution of educational processes. Flipped learning cannot be imagined without the use of technology. In every flipped learning approach, technology has to be integrated into teaching and learning activities. Internet technology is recasting education. Massive open

online platforms offering courses such as Coursera, edX, Udemy or learning management systems such as Blackboard have facilitated the application of flipped learning to remote learning. Before 2012, while the idea of flipped learning was limited to the idea of the “flipped classroom”, technology was an independent tool that could be integrated into education. By contrast, it is now an essential milieu of this pedagogical approach. Video or Web 2.0 tools can be integrated into flipped learning. Teachers, professors, and other educators now apply emerging technologies developed by others.

Thus, flipped learning is an approach that integrates technology in varying degrees to enhance the learning experience. For example, an analysis of 316 papers used in this study to highlight trends and outcomes of research into the flipped learning approach shows the number of studies that used several technological tools to support flipped learning in 2012–2018 (see Figure 1). The distribution of technologies referred to in the research papers lends itself to the following categories: MOOC (e.g., Coursera, Udemy, edX, Courseware, MIT); video (e.g., YouTube, TED-Ed, Khan Academy, video lectures, Vodcast, animation); learning management systems [LMS] (e.g., Moodle, Blackboard, Desire2Learn, iLearn); Web 2.0 Tools (e.g., EDpuzzle, Kahoot!, Scratch, Google Forms, Padlet, Online Quiz); audio recordings (e.g., podcasts); social media (e.g., Facebook, Twitter); learning labs (e.g., E-book, Cengage, Pearson Learning Catalytics, eXeCute); video conference tools (e.g., Zoom, Skype); CD, DVD, CD-ROM; simulations (e.g., simulator models); and no information in which the papers did not specify the tools.

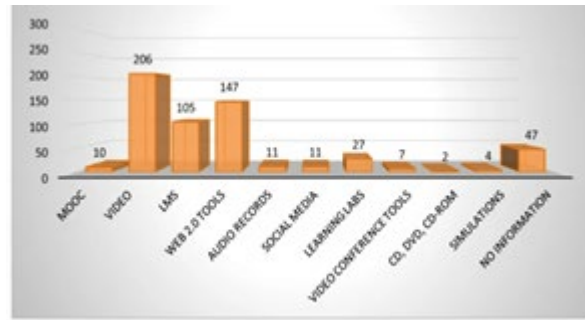


Figure 1. Technologies used in Flipped Learning

Programming languages and comparison:

After a survey in 2019 it was that Java, C and Python were the most popular programming languages, following graph shows the result of the survey (Figure 2 and 3).

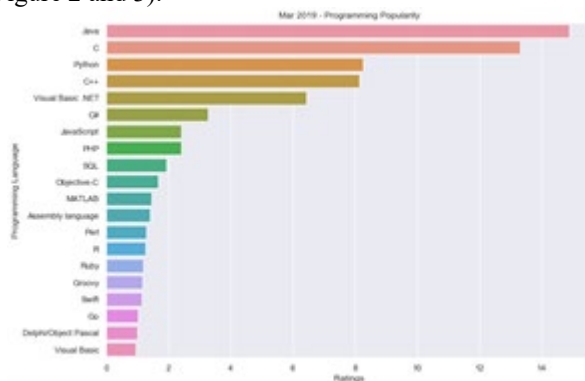


Figure 2. Programming Language Popularity (March 2019)

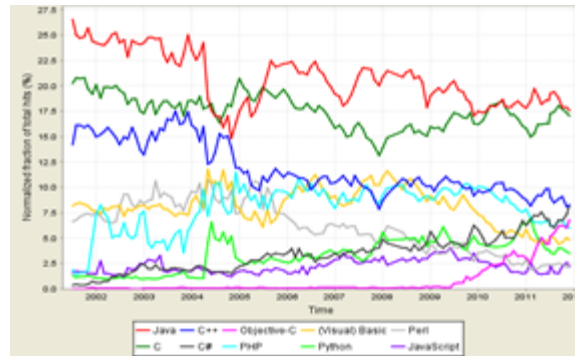


Figure 3. Programming Language Popularity (2012)

Comparison by speed:

Different programming languages have different processing and running speeds according to their complexity and internal architecture. Java was the most popular language according to the 2019 survey but in terms of speed, it is not the fastest. The below graph shows the speed comparison of various programming languages (Figure 4).

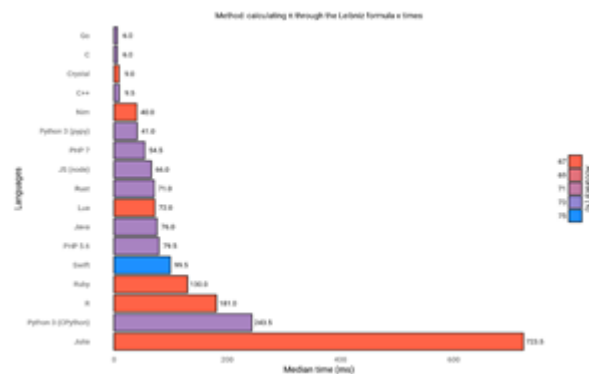


Figure 4. Speed comparison of various programming languages

3. Methods

System Description

Coding platform is a technology that focuses on competitive programming challenges among students in college. The programming challenges can be solved in a variety of programming languages like C, C++, Python, and Java. On the student's side, when a student submits a solution to a programming challenge, their submission is scored on the accuracy of their output. Students are then ranked on the leaderboard and earn badges based on their accomplishments to drive competition among students. The most important part of this system is that it shows the students their strengths and weakness based on their performance, which helps them develop accordingly. Faculties can update problems with test cases anytime and assign tasks to students and also conduct semester practical examinations on this platform. During placement, we can request recruiters to conduct coding rounds on this platform which might impress the recruiters (Figure 5).

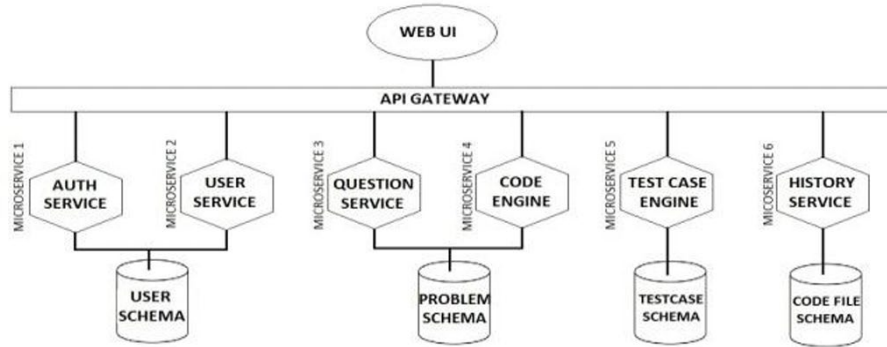


Figure 5. A broad overview of the microservice style system architecture

Micro-Services:

Microservices is a way of architecting the software process functionalities to several micro-processes which all in the whole combined can together constitute a working software product setup. The microservice architecture enables the continuous delivery and deployment of large, complex applications.

Front-End:

We have used the ReactJS library for creating User Interfaces. For managing and centralizing the application state, we have used an open-source front-end library “Redux”. For styling purposes, we have used a simple customizable, and accessible library of React components called Material UI.

Back-End:

The back end of the application comprises many microservices. For the authentication, database, hosting and cloud functions, we are using Firebase. In the application, we are using two types of databases: a Document-Collection database and a Real-Time database. We are also using an open-source online compiler called Judge-0. All these microservices are hosted on the Google Cloud Platform.

4. Results and Discussion

The results are presented in Figure 6, 7, 8, 9, 10 and 11).

THEBETTERCODE

FEATURE

LOGIN

REGISTER

A Better Way to Labs.

A clean and simple interface to conduct coding practicals and organize all submissions in one place. Just open your browser, all your submissions and IDE comes along you anywhere and anytime. Try it for free.

Open Console



Figure 6. Homepage Screenshots: Homepage that explain features that our app provides.

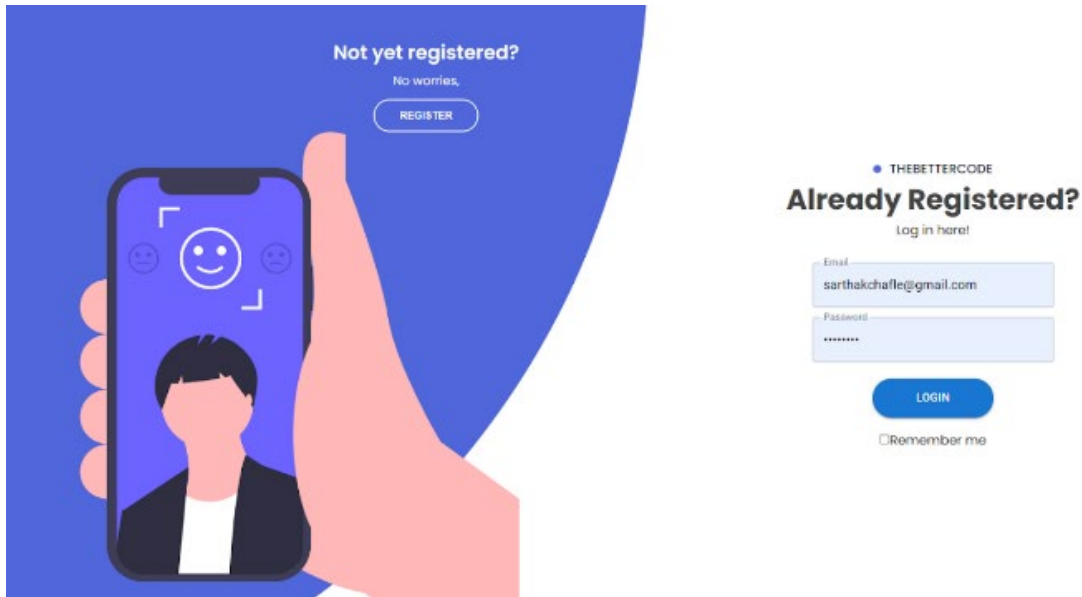


Figure 7. Login Page: login forms that takes credentials and give access to user.

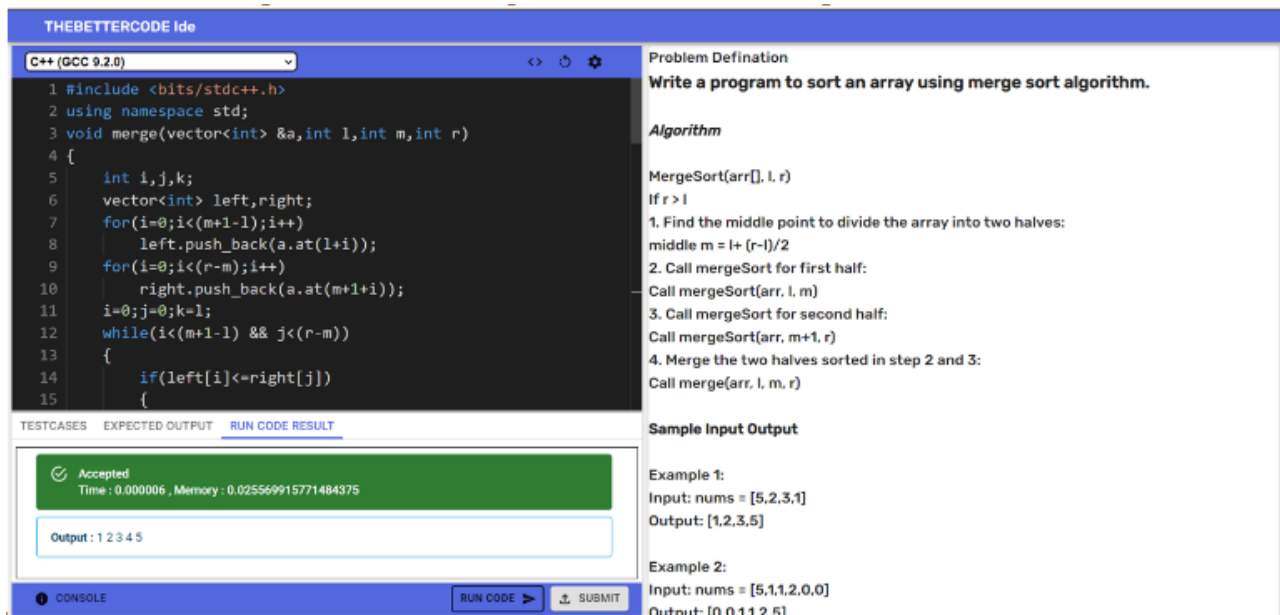


Figure 8. Assignment Page with IDE: Page where the student completes the assignment and submit it. Its half section contains the assignment definition and sample input/output cases and the other half is a code editor that supports 30+ languages.

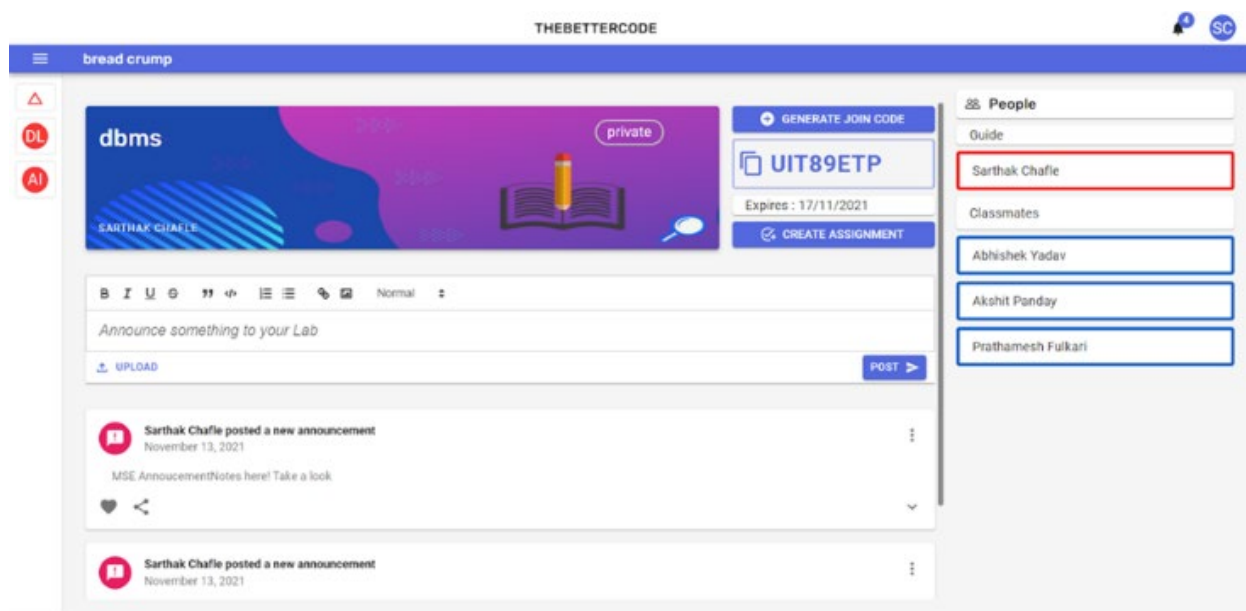


Figure 9. Lab page with Students and Teacher view: This is the lab page, It shows the teacher and students list and all the announcements and assignments posted in it.

The screenshot shows a 'Create Assignment' form. At the top, there's a title 'Create Assignment' with a close button and a 'CREATE' button. The form is divided into three main sections: 'Title', 'Problem Statement', and 'Input/Output'. The 'Title' section has a text input field labeled 'Title'. The 'Problem Statement' section has a larger text area labeled 'Problem Statement'. The 'Input' section has a text area labeled 'input'. The 'Output' section has a text area labeled 'Output'.

Figure 10. Create Assignment Page: This is the form to create programming assignments.

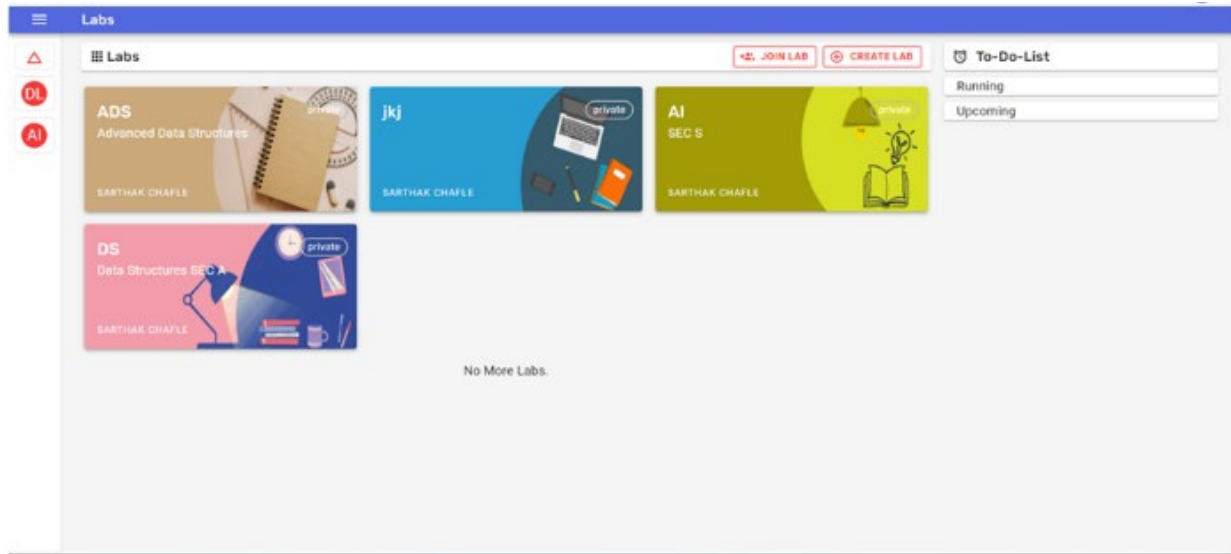


Figure 11. Labs List: This is an initial dashboard for teachers and students where they all labs that they created or joined.

5. Conclusion and Future Scope

5.1 Conclusion

- This platform can be used in universities, colleges, and schools to manage assignments and work of students in a single place.
- Instead of manual checking of practical of the individual student, teachers can use the feature of automated checking based on predefined test cases.
- Students can code in a variety of different languages of their choice in which they are comfortable.
- Students and Teachers will have a room where they will be able to store all lab-related or assignment-specific notes and material all at a single place.
- This project can be commercialized and can be used in multiple institutions

5.2 Future Scope

- This project can be used on a large scale as the number of users increases.
- This platform can be commercialized based on a subscription model wherein the institute needs to pay a subscription fee for each student who is using the platform rather than purchasing the entire application.
- We can monetize the application by integrating advertisements for various college events and programming contests.

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Biographies

Dr. Rakhi Wajgi received her Bachelor of Engineering degree from Pune University in 2004. She completed her M.E. in Computer Science and Engineering from BITS Pilani, Rajasthan in 2008. She is the Head of Department (HOD), Computer Technology, Yeshwantrao Chavan College of Engineering, Nagpur. She has around 12+ Yrs of teaching experience. She has been awarded a Ph.D. in Gene Regulation from Nagpur University in 2019. Her area of research includes Data Structures, Operating Systems, Parallel Programming, and Bioinformatics.

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