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CodeBox: A Code Learning Platform

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Abstract: *The Internet has proved to be a life-changing invention of our time. Not only it is itself an invention, but it has been the key player to major things that have been invented in the twentieth century. The internet has proven itself in re-inventing almost everything, with education being no exception to it. CodeBox is also an effort, via the internet, to educate the young minds on the how-tos of coding and developing the spirit of competitive coding. It takes a lot of time and practice to get good at coding, and CodeBox aims to assist the user in this journey. CodeBox will focus on giving users the required data to learn the basic skills of programming, and then eventually on enhancing the skills required for competitive programming and give the users a sense of the real world competition. It will enable the users to learn, practice and compete with others on the platform. It provides different parameters for self-analysis and evaluation like, time taken to complete the challenge(in competitive programming it is very important to know how fast your code executes so that you can get it to run under the time limit), complexity of algorithm used, scores of your peer group.*

Keywords: *Competitive Programming, Coding, Internet, Learning, Practice, IDE, Problem Solving, Analysis*

I. INTRODUCTION

CodeBox, as the name suggests is an e-learning web app which will primarily focus on providing a platform where students and coding enthusiasts can learn the basics of programming through smart modules. The soul goal of Codebox is to provide a learning medium for the teachers, students, and all those who are keen to learn and enhance their coding skills. Moreover, to make the learning easy and fast, Codebox itself provides modules for learning and developing new skills about the different programming languages. It will also focus on making it easy for students of non-technical background to learn coding from scratch.

In the field of competitive programming Codebox provides a great way to showcase the students problem-solving skills, which is certainly something a lot of companies look for. CodeBox will focus on giving users the required data to learn the basic skills of programming, and then eventually on enhancing the skills required for competitive programming and give the users a sense of the real world competition.

The importance of this project increases when we consider that students are coming with different previous knowledge of programming in the initial courses in computer science. The biggest challenge for teachers lies in teaching a broad, diverse group of students who come with a variety of knowledge. Teachers find it difficult to discover an appropriate level of difficulty of teaching content for all students. If the level of presentation is too low some of the bright students will be bored and will be demotivated to work. This project enables users to access content as per their own speed and capabilities. They can clear their doubts using the discussion forum and can focus more on typical topics.

II. LITERATURE SURVEY

Wenli Looi's paper on Analysis of Code Submissions in Competitive Programming Contests[1] analyzes contest submissions on Codeforces, a preferred competitive programming website where participants solve about 5 to 10 algorithmic problems in a standard contest. Though it didn't achieve the accuracy as expected, the GDA model was easier to understand and allowed to detect and point out particular differences in coding techniques between programmers of different ranks and countries.

S. Wasik et al attempted to review The Online Judge Systems[2], Online judges are systems designed for the reliable evaluation of algorithm source code submitted by users, which is next compiled and tested in a homogeneous environment. The study stated that online judge systems, integrated by crowdsourcing concepts, usually played a vital role in accurately and efficiently solving complex industrial- and science-driven problems.

A quasi-experimental design was used by Gandikota Ramu to research the IAREBuildIT Tools[3] impact to build problem-solving power of coders by motivating himself to accomplish and work with an online coding platform approach. In the mentioned case study about 7000 Institute of Aeronautical Engineering students were involved. The duration of the experiment was twelve months. The results evidenced that, student's coding efficiency increased using this approach. Ultimately, this case study suggests many convincing recommendations for online coding and problem-solving in engineering education.

Babaali, P., & Gonzalez, L.[4] tried to explore the effects on student performance of the utilization of a computer software program to supplement instruction in an entry-level mathematics course at the undergraduate level. The analysis of quantitative data then led to the conclusion about the effectiveness of the software as well as recommendations for future iterations of the course and others like it.

Paul Dervan in his report on Enhancing In-class Student Engagement Using Socrative (an Online Student Response System)[5], analysed the effectiveness of the Socrative cloud-based Student Response System(SRS) in enhancing student participation and the learning skills, in contrast with the traditional lecture setting.

The study suggests that the use of this system offers lecturers the opportunity to quickly and easily enhance the delivery of their lectures in a way that increases teachers and student interaction which leads to a better understanding and easy learning for the students.

Sezer Kanbul & Huseyin Uzunboylu[6] in their research paper shared the significance of computer science in the field of coding and robotics application stating that software developers in North Cyprus are lacking a significant amount of knowledge for developing software.

Thus, to develop the skills of coding training should be started from the student phase of one's life for providing the solutions for problems and having enough ideas in the fields of profession, human sciences and social sciences by using computer sciences and applications.

Kirsti M Ala-Mutka in her paper on A Survey of Automated Assessment Approaches for Programming Assignments [7] stated that automatic assessment tools can be used to help teachers in assessment of students tasks and in addition to it to help students' working process with automatic feedback. Major advantages of automation are the speed, availability, consistency and objectivity of assessment.

III. PROPOSED SYSTEM

Competitive Programming is the best way to showcase our problem-solving skills and also something which a lot of companies look for. CodeBox will focus on giving users the required data to learn the basic skills of programming, and then eventually on enhancing the skills required for competitive programming and give the users a sense of the real world competition. It will enable the users to learn, practice and compete with others on the platform.

It provides different parameters for self-analysis and evaluation like time taken to complete the challenge(as in competitive programming it is very important to know how fast your code executes so that you can get it to run under the time limit), complexity of algorithm used, etc.

CodeBox intends to have the following features:

- A. Open source
- B. Modular and Easy to use.
- C. Scalability is simple.
- D. Data Visualization.
- E. Challenge history will be stored.

Main Modules of the project & their functionalities:

- 1) *Compiler*: It is the core module of the entire application. It gives us options to pass custom test cases input to check our code on our own while practicing, we can download our code, change themes of our compiler and perform many other things in real time. The compiler creates JSON data and sends it to API via POST method, the API processes the data and returns the JSON response to the compiler. We are using the Hackerearth API in this project which is providing us various useful functionalities. The API provides endpoints for compiling and running code in different languages.

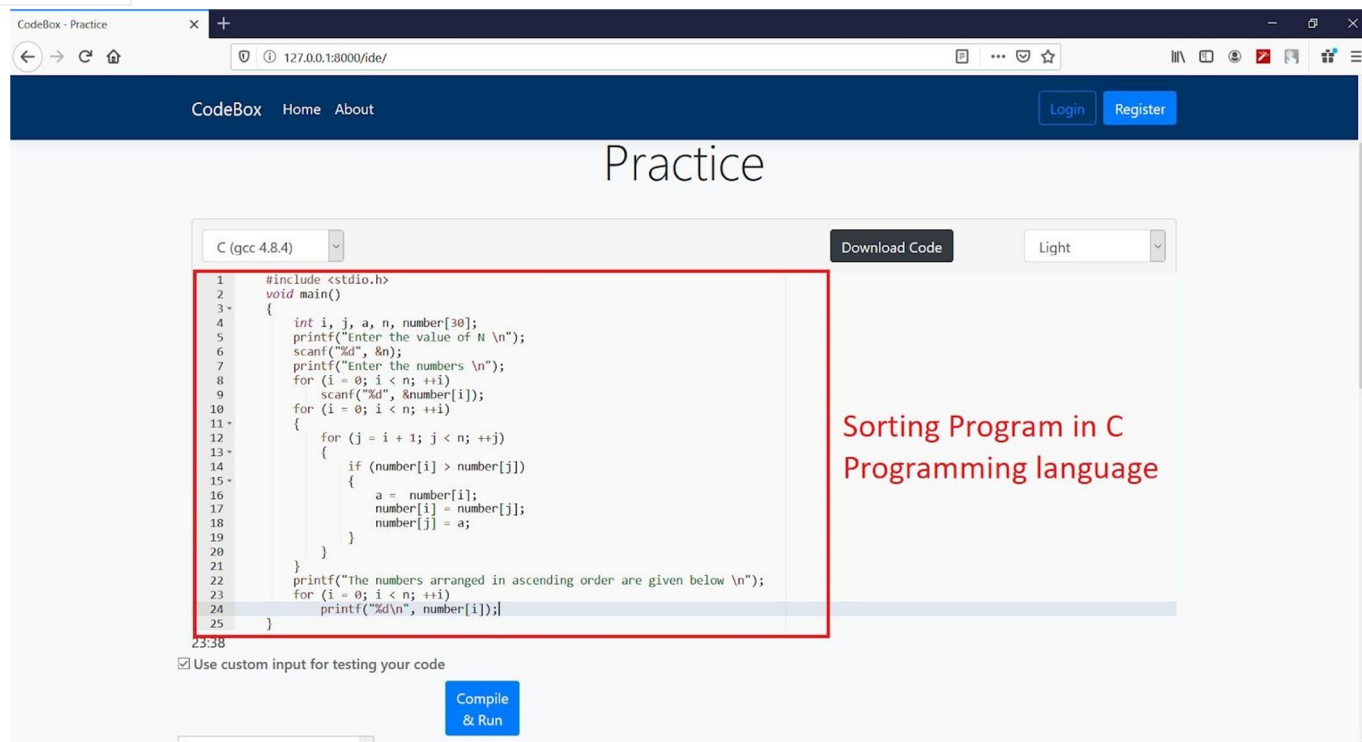


Fig.1 Compiler

- 2) **Courses:** This section contains tutorials on different topics related to computer science engineering. It mainly focuses on topics like competitive coding. It consists of video lectures and study materials on different topics related to basic concepts of different programming languages.

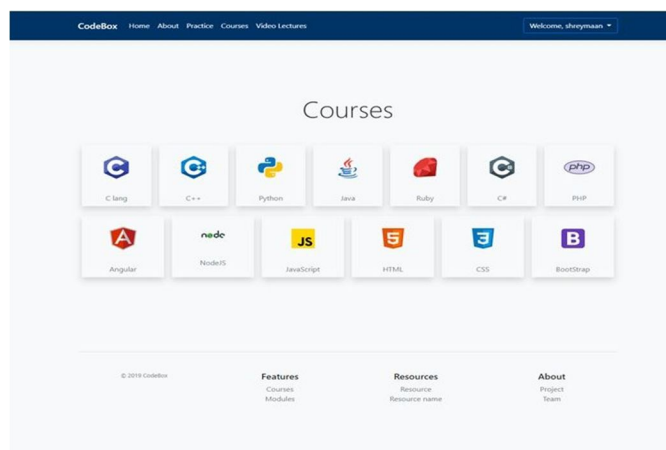


Fig.2 UI of courses module

- 3) **Registration Page-** It is basically a registration form which consists of a list of fields that a user will input data into and submit to become a registered user of CodeBox. CodeBox uses registration forms to sign up new users for subscriptions, services, or other features which are not available to the guest users.
- 4) **Login Page:** The login page is where you have to input the correct credentials to get to access the backend of your website. Once logged in, you can see your dashboard, access courses, practice coding using IDE, update the theme as well as make other customizations to your profile.
- 5) **Discussion Forum:** It is a module which enables users to interact with other active members of CodeBox. Users can discuss their problems, doubts and help other members on the platform. It is concerned about problem solving of different users and creating a healthy competitive environment.

IV. FEASIBILITY STUDY

The system is highly feasible as it involves the development of functionalities basic in general approach. The feasibility rate for this system ranges from 8-10 on a scale of 10. The internet, despite being an invention itself, has proven to be a key factor in re-inventing almost everything, with education being no exception to it. CodeBox is also an effort, via the internet, to educate the young minds on the how-tos of coding and developing the spirit of competitive coding.

CodeBox will be a web app which will primarily focus on providing a platform where students and coding enthusiasts can learn the basics of programming through smart modules. It will be an accessible-to-all service through which it intends to target the school going students and the undergraduates of technical background. It will provide different options to the user based on individual progress based on their trackboard. It will also focus on making it easy for students of non-technical background to learn coding from scratch. CodeBox intends to give the user a descriptive analysis of their coding abilities, and help them grow down the lane by suggesting areas where the user needs to improve. Coming to the API we are using, it is HackerEarth API V3, it can be accessed via a simple API key based authorization process. You need to register your web application in order to get a client specific client_secret which must be provided while communicating with the API. Every JSON object returned by the API always consists of at least two attributes, 'message' and 'errors'. 'message' contains the description of errors encountered while processing of a request and 'errors' may contain key-value pairs which were the cause of the errors.

```
# From HackerEarth API
RUN_URL = 'https://api.hackerearth.com/v3/code/run/'
CLIENT_SECRET = '6bd33be8349bbb9496f094d690c6d9141a5d9ea'

def runCode(request):
    if request.is_ajax():
        source = request.POST['source']
        lang = request.POST['lang']
        data = {
            'client_secret': CLIENT_SECRET,
            'async': 0,
            'source': source,
            'lang': lang,
            'time_limit': 5,
            'memory_limit': 262144,
        }
        if 'input' in request.POST:
            data['input'] = request.POST['input']
            r = requests.post(RUN_URL, data=data)
            return JsonResponse(r.json(), safe=False)
        else:
            return HttpResponseForbidden()
```

Fig.3 API request

When a request runs successfully, the JSON object returned might look like:

```
{
  "errors": {},
  "id": "8b3cfbe",
  "code_id": "8b3cfbe",
  "message": "OK",
  "compile_status": "OK",
  "run_status": {
    "status": "AC",
    "time_used": "0.1005",
    "memory_used": "64",
    "output": "Hello",
    "output_html": "Hello",
    "signal": "OTHER",
    "status_detail": "N/A",
    "time_limit": 5,
    "memory_limit": 262144
  }
}
```

Fig.4 JSON output from API request

V. SIGNIFICANCE

As we have seen above, many observations and researches have been done in the field of online learning platforms and enhancing problem solving abilities of individuals. This project on successful implementation would prove itself as an asset to the users in enhancing the coding skills and increasing their problem solving efficiency. It will expose the users to the real world problems and increase their logical thinking ability. It doesn't really matter whether you are from a technical background or not, this project ensures easy learning of the users starting from the basic concepts. The motto of this platform is to overcome the fears of users when they think of programming as a skill. Programming can't be taught overnight but this platform will ensure that users who are really dedicated to learn new skills of programming will be provided with the best study materials and lectures with proper mentor guidance. It will work on giving users an exposure to competitive programming. This platform ends the need of visiting different platforms for coding, learning and taking references as it itself can be utilized for all these operations.

VI. CONCLUSIONS

In today's world, we rely heavily on computers for everything. And without coding, computers would literally do nothing. They would be completely useless. CodeBox will focus on providing users with an easy-to-learn environment wherein the user can learn the basics of coding. It will focus on providing hands-on experience to practice different programming paradigms using well-defined course modules.

It is said that one learns the best in a competitive environment, and when we talk about coding, competitive coding comes into our mind. In the field of competitive programming Codebox provides a great way to showcase the students problem-solving skills, which is certainly something a lot of companies look for. This project focuses on enhancing the skills required for competitive programming and gives the users an exposure to real world competition. It enables the users to learn, practice and compete with others on this platform. It provides different parameters for self-analysis like total time taken to complete the challenge, complexity of algorithm used, etc. Despite a lot of similar services, CodeBox still has a large audience to cater its services as they have not been reached out in an approachable and easy manner.

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