

Skill Forge – Peer to Peer Coding Platform

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Abstract— Since 2020, the majority of tasks assigned to students studying Computer Science have transitioned to online platforms. A number of these activities involve conducting interviews, delivering lectures, and participating in meetings. Numerous students studying Computer Science have encountered the challenge of providing access to their code to classmates for collaborative purposes. Having a unified platform where two individuals can simultaneously collaborate on a single code in real-time will streamline the task. In this manuscript, we have outlined the approach towards implementing said platform. We have also discussed the current comparable platforms and their constraints.

Index Terms— Peer-To-Peer Communication, Coding, Video Conferencing, Interviews, Real-Time Collaboration, Ai Assistant and Sharing.

I. INTRODUCTION

I.A BACKGROUND AND SIGNIFICANCE

Currently, video conferencing has become a widely utilized method of communication. Communication has become increasingly important, especially in the context of the changes brought about by the pandemic in both our personal and professional spheres. A variety of modifications, specifically in employment practices, have been implemented, such as the necessity for telecommuting, digital communication, and the prevalent integration of virtual tasks into daily operations by a majority of companies.

The recruitment methods utilized by the companies were also influenced by this change. The transition to a virtual recruitment process was widely accepted by most individuals, leading to rapid implementation within various organizations.

Due to the absence of geographic constraints and the ability to identify high-quality applicants, organizations were able to recruit individuals from diverse

global locations through the use of virtual recruitment methods.

The challenges resulting from these transformations encompassed the implementation of fair and inclusive recruitment procedures. Tech companies sought to tackle this problem by organizing competitions that incorporated certain levels of proctoring to reduce the prevalence of unethical practices.

This presented clear limitations as there were often methods to circumvent the existing proctoring system. In order to address this challenge, our objective was to create a platform that facilitates communication between peers and allows both the interviewer and interviewee to collaborate on the designated coding task.

This allows the interviewer to confirm that the candidate is not resorting to unethical methods by examining both the user and the problem they are addressing within the same framework.

The peer-to-peer coding platform provides a mechanism for individuals to collaborate on coding projects. Numerous computer science students encounter difficulties when faced with the challenge of collaboration.

They share their coding work with their colleagues in return for help. We posit that simplification can be achieved through the utilization of a unified platform allowing two individuals to collaborate on a singular codebase concurrently. Moreover, an interactive approach with multiple perspectives facilitates a deeper understanding and clearer resolution of complex issues.

I.B PROBLEM STATEMENT

With the rise in demand for remote work and virtual communication as a result of the COVID-19 pandemic, the significance of effective and dependable tools for remote collaboration and communication has heightened. Peer-to-peer coding platforms have become increasingly utilized in software development for facilitating remote collaboration among programmers. Nevertheless, these platforms frequently encounter obstacles such as conflicts and latency issues when multiple users collaborate on the same code concurrently. Moreover, it is imperative to uphold the integrity of the collaborative process by minimizing unethical practices during virtual interviews and promoting equitable sharing of code among programmers.

I.C OBJECTIVE AND SCOPE

The goal is to develop, install, and construct a peer-to-peer coding platform using programming transformation technology that resembles the live programming of two or more programmers.

The research will include the identification of the essential requirements for such a platform, the design and development of the platform using suitable technologies and resources, and the evaluation of the performance of the platform in the detection of unethical behaviors during virtual hiring processes.

In order to recognize this goal, the paper will target issues related to collaboration tools and proctoring system that fail to provide a fair and ethical online hiring processes. This research also aims to find out the possible benefits that a member of peer support system may get from this kind of support group. the enhancement of cooperation among computer science students, developers and engineers can be attained by learning techniques through the programming environment.

The platform will be made by using the mix of front-end technologies such as HTML, CSS, JS and ReactJS and back-end technologies including NodeJS. The system will use PostgreSQL database. The platform's effectiveness will be evaluated by testing it on users and analyzing the platform's potential to do identity checks and prevent ethical issues in virtual hiring

processes, as well as measuring its impact on teamwork among computer science students and professionals.

The research aims in developing new and better technology regarding virtual team work and hiring in the domain of computer science. The spokesperson should also outline the ways in which P2P collaboration platforms can help other studies.

I.D METHODOLOGY AND APPROACH

The, methodology and my approach to the issue, which, included a 3-step plan to address mental health issues faced by college students.

The procedure used in this study consists of creating and applying a peer-to-peer coding platform based on operational transformation technology, using Node.

JavaScript for our back-end scripting language and the database system will be provided by PostgreSQL. The approach of this project encompasses the merges of software development and experimental research with aim of establishing whether the platform is conducive of remote collaboration among programmers.

The first step in this methodology is to carry out a comprehensive analysis of existing peer-to-peer coding platforms, identify their strengths and weaknesses and decide on the key features needed for effective collaboration. After this analysis, team will define the structure and proposal of building the platform using Node. Using hosting and storing our data on js and PostgreSQL which will help ensure that we have incorporated all necessary features for remote collaboration.

Operational transformation technology is going to be used to synchronize code changes in real-time, and everyone will have access to the latest version of the code. With the implementation of this solution, several coding contributors can coordinate a shared coding base without having to wait for others or committing concurrently any issues that might arise.

The subsequent stage is testing the platforms functional and usability through a wide series of experiments. A group of programmers will be invited

to use the platform to work on a coding project, and at the same time, their interactions and productivity will be monitored and recorded. The data obtained will be analyzed in order to assess the efficiency of the platform in enabling remote collaboration, similar to the areas requiring improvement.

Overall, this research intended to provide a solid foundation for the buildup of reliable tools for remote code achieving this with the general trend towards distributed work and home computer using online communicating.

Through the application of the operational transformation technology and a user-friendly interface the platform that was developed in this study can enable the smooth communication and the increased productivity of the teams that are working remotely.

II. REAL-TIME COMMUNICATION WITH WEBRTC

A. WebRTC Architecture

WebRTC adheres to client-server architecture, with peer-to-peer communication between browsers followed in Figure (1). The interaction oversees the message route for providing the middle ground for the browser to flow the message channel.

The data is transmitted through Web Servers which help in modifying, interpreting and managing the signals as needed by WebSockets or HTTP. Unlike the HTTP environment where they are unique and clearly defined, in WebRTC the signals either are one of the components of the application or they are not specific. The servers assigned to the web pages can exchange information with each other using a signaling protocol standard (e.g., SIP- Session Initiation Protocol or Jingle). Another option is to use a property signaling protocol for this.

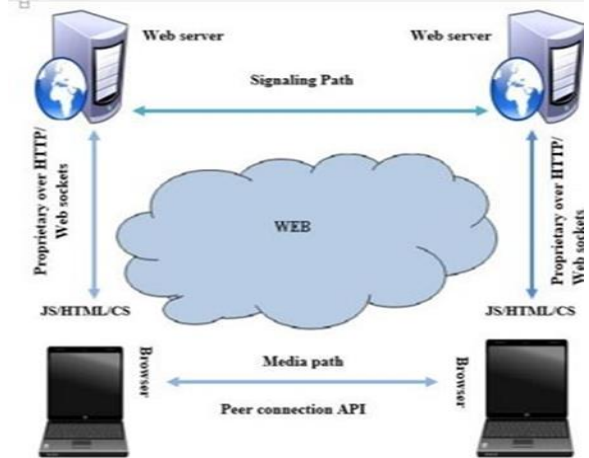


Figure 1 WebRTC Trapezoid

B. Browser's Role in WebRTC

It is moreover the WebRTC API (APIs are Application Programming Interface) that is responsible for the communication of WebRTC applications which are typically designed with HTML5, CSS and JavaScript with various web browsers.

Figure presents an interface that supports (hypertext links, which makes it user-friendly and simple to control the functionality of the Real-time browser).

The transmission and reception of signals between the online participants can be carried out to a large extent by using the Web Socket technology [6, 8].

The WebRTC web application, through solid techniques of communication, reaches browsers without any delay (Forms of proactivity). g. This is mainly in terms of the immersiveness (For instance, the choice of colors, images or the speed of content delivery) and instructiveness (Ensure browser compatibility), making the website attractive to visitors. g. Moreover, the cross- browser notification will be enough (in that case, the recipient will receive a cross- browser notification). [4, 3]

Direct media streaming between the two browsers, inside the media path parley, and the creation of an instance of multifarious interaction through the following entities are all part of real-time imaging communication (like a video and audio call) between two browsers [9]: Direct media streaming between the two browsers,

inside the media path parley, and the creation of an instance of multifarious interaction through the following entities are all part of real-time imaging communication (like a video and audio call) between two browsers [9]:

- Script evaluation facility is supported by both devices ahsing the caller and his user browser (using JavaScript API).
- The JavaScript application is run by a web server, through an interface known as the caller and the application provider.
- The application for browser JavaScript API, the JavaScript application for the called and caller browsers.

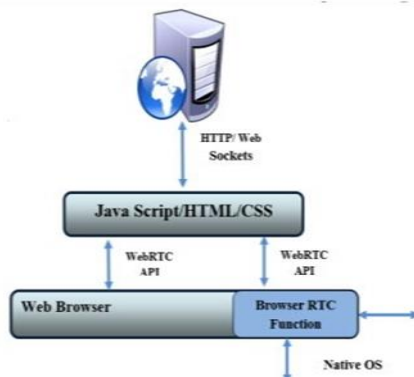


Figure 2 RTC and the browser

1) WebRTC API(Application Programming Interface)

The novel browser has the potential to ease the adaption of the JavaScript programming language through the assistance of the W3C WebRTC API. The necessary function for setting the video, audio, and data channel is provided by the real-time browser function, which was implemented at the browser centre and is shown in Figure (2). The design of the API (Application Programming Interface) has been based on three fundamental ideas: MediaStream, PeerConnection, and DataChannel [11].

1. MediaStream

It can use a local media device, such as a webcam or microphone, to stream media using the term "MediaStream"[11,4][4]. The web application must use the "getUserMedia ()" function to ask the user for permission to create and use a local stream.

2. PeerConnection

RTC PeerConnection of RTC is responsible for the establishment of a connection between two users and the output data is read from MediaStream. The STUN and TURN protocols, provided by Google [10], are employed by ICE (Interactive Connectivity Establishment) as the Network Address Translator's nucleus to create peer-to-peer connections.

3. DataChannel

The RTCDataChannel API makes possible the exchange of random data between two peers in a bi-directional data channel. undefined

- Carrier that is reliable or unreliable.
- Confusing the sequence of the message.

2) The Process of Establishing WebRTC

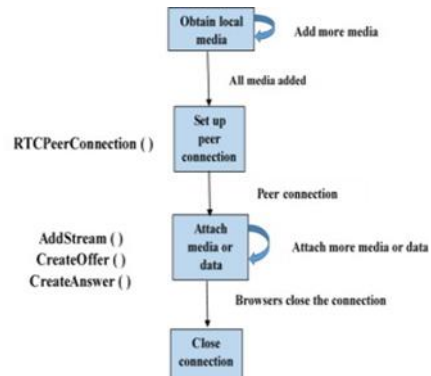


Figure 3 Establishing WebRTC Session

C. TOOLS AND TECHNOLOGIES USED

1) HTML: The webpage layout or construction by using the markup language, Hyper Text Markup Language (HTML), is known. HTML elements determine how the browser will display the content.

2) CSS: HTML specifies the structure of web pages, while CSS is the language used to style them visually. The purpose of this technology is to create a standardised writing system visible to both the machines and the human readers that will be created specifically in a markup language style. It gives an extra functionality to HTML. It is usually accompanied by HTML to change the style of web pages and user interfaces.

3) React. js: React is a free open-source frontend JavaScript library which helps to design user interfaces and UI components with the help of reusable elements. It also is to build single page

applications which are business-targeted.

In react, you create your apps by building the components that you can think of as individual Lego blocks. These parts are the micro-components of the application's final interface; and, when combined, they signal the finalization of the application's user interface.

4) Node.js: At the back, a Node.js runtime is jotted down. Now JavaScript can be used outside of a browser. We can connect JavaScript and Node.js together to create an online platform (web server). js. It's a free runtime environment, which has the same syntax as JS. It permits for writing server-side scripts and command line tools that run on the web.

5) Express.js: An open source Node.js framework for building backend servers with JavaScript. Naturally, it's pretty common and it's widely used to improve endpoints.

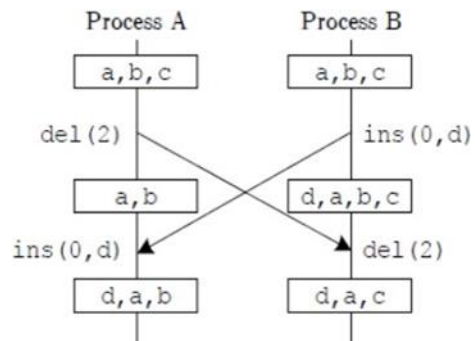
6) Peer.js: Availability of an open source Javascript library which is used to make WebRTC-driven peer-to-peer connection feasible.

7) Netlify: We utilized Netlify to create a platform for our web application. It is a PaaS cloud service that is a web host for applications.

III. OPERATIONAL TRANSFORMATION

It was in 1989 when Ellis and Gibb [1] had a creative idea of a modifiable operation process (operational transformation). The idea of Operational Transformation was born out of research on collaborative editing and computer-supported collaborative work (CSCW). We expect the data sets will be handled offline by each person (on their devices), and it shall be only the actions performed by the individual local data sets which will be sent to the other participants. Here the activities are restructured using Operational Transformation which resolves the inconsistencies also and make sure that all transmitting nodes continuously give the same supplies. It is linked to the place and the way activities are conducted. It is a necessity for software that can be updated in real time. Operation transformation system works a two-layer architecture, where the transformation control algorithm and the transformation functions are implemented at the first and second tiers respectively. The transformation control algorithm chooses the transformation function to apply to each group of

simultaneous operations depending on the characteristics of those sets. The techniques of application-specific transformation functions and the transformations that are controlled generically can only thrive because the (basis for) the discovery of the acceptable transformation post-conditions has been proved. It involves the transformation of documents from one file format to another without any significant distortion. An undo or redo is a kind of change that are made to the states of the document rather than the actions themselves. The major part of what undo and redo is for.



IV. A.1 OPERATIONAL ACTIVITY FUNCTIONING

By means of an example, let's say, a list [a, b, c] which is able to carry out simultaneous modification as a result of operations.

First of all, it is the list index that starts at 0, therefore, we will consider that the process A wants to delete element C at index 2. This will make the execution OPA equal to "del" or removal of the list index element, which starts from 0. (2) The OPB command + is a result of direct effects that can be witnessed during the same time as insertion a new element d on the list (which is also called index 0). (0; d). Both OPA and OPB are immediately applied to their respective local lists through the mechanisms that are being defined here. After waited for quite a while, they will be implanted the portion of the organ that has been an antecedent bypass transport technique. The provided operation would be applied without any operational transformation that would lead to the different list for the processes A and B that will come in the form of figure 1. In other words, the process A would be represented by the list [d; a; b], while the process B

would be represented by the list [d; a; c]. As a result of this, the element that process A was searching for was pushed from the index 2 to the index 3 because of the element which d was added formerly by process B. The situation was solely caused by the element d being inserted at step B.

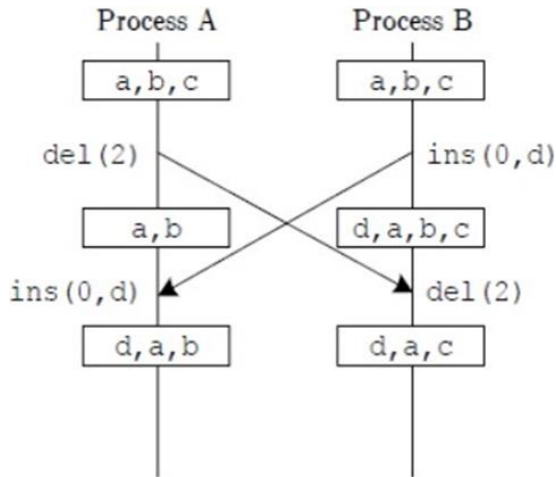


Figure 4 is a diagram that shows the absence of operational transformation.

Therefore, the result would cause OPA to make the change instead of process A, thus maintaining the desired result. The same list [D; A; B] is produced by both processes by process B using the converted operation OPA with index 3 at its left in figure 2 as shown in figure 2 above.

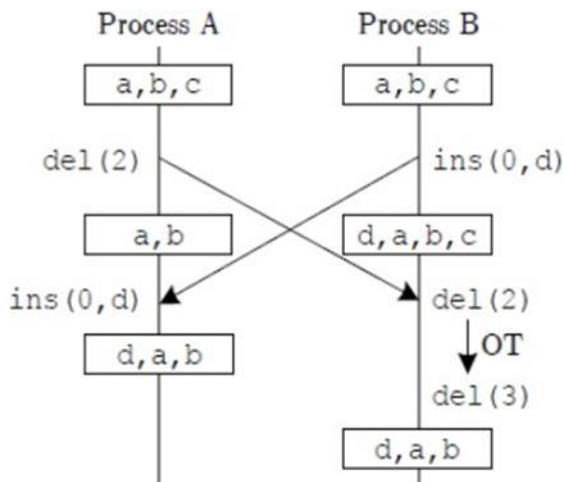


Figure 5 is about Operational Transformation

V. RELATED WORK

The main reason as to why Operational Transformation targets for uniformity is to gain consistency in the procedure where editing is done collaboratively. There are consistency models in multiple shapes and forms which can be used for ORT, CSE or management of consistency. Some of the computer systems where maintaining the consistency is a critical issue are operating systems, database management systems, distributed shared memory, and groupware systems.

Following the formatting rules is as simple as using this document as a template and just typing your text into it.

Forthwith, some demonstration group editors have been designed and built by different research teams with the purpose of studying architecture design and challenges of implementation, so as to assess the applicability of transformation-based consistency maintenance methods. GROVE has already been tested by a lot of different groups applying various design objectives focusing on the eye of the end-user plus the accumulation of knowledge and expertise of GROVE usage.

Besides, the collaborative undo processes which users initiate themselves are significantly benefited from the operational change. Operation Transformation or OT helps Google develop a range of products which are popularly known for their adaptability to the users. Yet, the products and services do not have an ostensible open-source license. Google Docs, Google Wave, ZohoSuite, JotSpot, MobWrite, SynchroEdit, ShareJS, SubEthaEdit (code editor), EtherPad, and Mockingbird are some of the online applications that use operational transformation as a concept. Racer, DerbyJS, OT.js, Differential Synchronization, Diff-

For these purposes, there are MatchPatch, DriveSDK, beWeeVee, and basically any other framework which is able to provide all of the necessary functions.

Google Wave: It is a platform for real-time collaborative editing. The name of this technology came from its inventor, Google who called it Google wave. The joint editing process is the sharing of a

document among several editors, who may be working on the same document simultaneously. A user can see the changes that the other user is making in the meantime and in real time, even the individual keystrokes on the keyboard. The collaborative editing of these rich text documents even in real time is now possible with Google Waves. Google Wave thus presents a direct consequence of which it makes individuals view each character as an individual user enter. People who use Google Wave can deal with more effective types of collaborative document editing environments. These environments therefore enable the users to make full use of standard word processor facilities like making things bold, changing a typeface, italicizing text, using bullets, and headers without any need to worry that other users would have their toes stepped on. Humanize: Google Wave's underlying concurrency management system is built on the principle of operation transformation, for the sake of achieving the following objectives.

Google Docs: Google Docs is a web-based word processor that is a component of the program called Google Drive. People can do this through creating, modifying, and working together on files with others placed in different locations across the globe. The editors who access Google Docs remotely are shown the changes in real time, so they can see the work done by other members of the team. It is also possible for several people to simultaneously access, open, and modify the same document. In return, there comes a notification whether the user files a comment, takes part in discussion or replies to another user's post. Users can argue the changes to be made in the chat that is below their drawing. Its main characteristic is that it can operate without the Internet. Once the Google Docs has been offline and a user makes changes, the changes are automatically uploaded whenever the user re-establishes an internet connection.

VS Code Live Share: The Visual Studio Live Share allows its users to work together on the project in real time - either on debugging or code editing process, using any kinds of programming languages and applications. You can easily send your current project to anyone you want without compromising its security, and if you need to, you can also share debugging sessions, terminal instances, localhost web apps, phone conversations, and much more. When the

developers join your sessions, providing access to all the editing context from your environment will enable them to begin working without the need for title-less repositories and a SDK.

On the other hand, unlike the more classic tandem coding, Visual Studio Live Share allows programmers to work together however, they still retain their own editing signature (for instance, theme and key bindings) and their cursors stay their own. This allows you to move from following each other to searching for the new topics.

engaging in your daily activities alone in the silence of the field and the vastness of the sky. Firstly, the fact that people can do teamwork as well as individual work makes collaboration closer to a natural experience for numerous other usual practices.

VI. LITERATURE REVIEW

V. 1 WEB-SOCKETS

The much-discussed trick for faking the initiation of the connection by server is the long polling. This becomes problematic for low latency applications because it causes long polling which means the client can make an HTTP connection with the server, which stays open only until the server receives a request and should respond. Nevertheless, Web Socket can also be used in client-server applications but web servers and browsers are where it is most often applied. The objective is thus to empower the browser-based apps to have an interaction approach that is full duplex with servers through initiation of single HTTP connection.

It allows the creation of long-term, single TCP socket connection between client-side and the server side, with bi-directional full-duplex communication capability, which transmits information instantaneously without exchanging signals, thus forming a data conduit with very low latency.

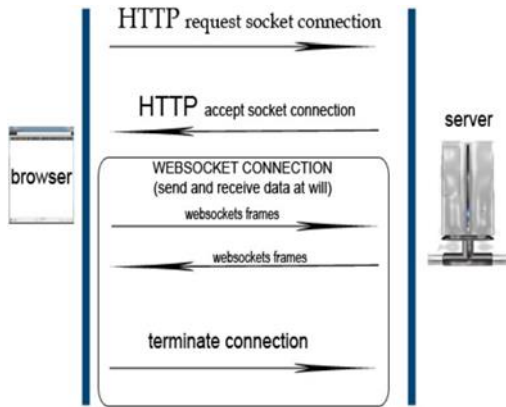


Figure 3. The phases of a websocket session's life cycle

Port number 80 TCP is employed for transmission of information. Compatible browsers are Google Chrome, Firefox and Edge, etc. The web application to provide support for it, a server is necessary. Any language, including Node.js, Java, Python, .NET, and Socket.I, on the other hand, may be the one who will be implementing the design on the server side of the application. For example, real-time social broadcast, instant chat softwares, and many online multiplayer games depend on websocket software.

```

undefined var Socket=new WebSocket(url,[protocol]
);
    
```

V. 2 RUST PAD

Rustpad which is 'a simple and powerful open-source collaborative text editor on the XForms/OpTrans protocol. It is a tool that helps people to interact in real time while writing code in their browser. Rustpad is a self-hosted and easy-to-use Code Editor with a Docker image. It has a clean and simple code and does not need any database involvement. There are seven alternatives to Rustpad (Online / Web-based service, SaaS (Software as a Service), Heroku, Cloudron) as well as Docker (container and microservices manager).

The server is programmed in Rust and uses the warp web server framework and the operational-transform library. Wasm-bindgen is commonly employed to convert the code for text operation logic into WebAssembly that runs in browsers. The front-end is in TypeScript and draws two-way communication with VS Code's Monaco, the code editor, through React.

Client-side code interacts with a central server that keeps in-memory data structures through the WebSocket. This leads to going faster, elides dependency provisioning, and facilitates testing. Documents are temporary and get destroyed either during process restarts or after only 24 hours of lack of activity as a tradeoff.

V. 3 CODE MIRROR

Code Mirror is a browser based open sourced code editor. The software possesses a number of language variants that offer a range of additional features, thus, making it more functional. It is implemented in JavaScript though. It offers such advantages as auto indentation, auto-completion add-ons, syntax highlighting, and a comprehensive programming API. Firefox, Chrome, Safari, Opera, as well as Internet Explorer, are adaptable to the memorable version.

V. 4 ETHER PAD

Etherpad is an online editor that is very pluggable and is open source. The real-time collaboration is provided as a complement.

Now there is no longer the need to exchange files by email; just create a pad, share a link, and get to work collaborating.

Just like Etherpad which is live multi-player editing that you would see online in the browser, users now have a chance to change the documents together and in real time. You and your friends, fellow students, or colleagues may rewrite the articles, press releases, to-do lists, and other documents that you are all working on at the same time by creating a shared document for you all to work on.

Every case grants import and export of the most common data interchange formats and enables access to all data via a well-documented application programming interface (API). And not only the already built-in features may be not enough for downloading new plugins that can expand the system options and achieve all the needs of the user.

An installation of the Etherpad is not prerequisite to you as you do not need to start up a server and setup the application. Just pick one of the instances that is available to the public and was set up by helpful people from different places of the world. Additionally, you

can set up a custom instance yourself on the guidance provided on their installation guide.

V. 5 CODEPEN

Recently, the use of peer-to-peer coding platforms has been on a rise among programmers. By such platforms, the users can work as a team on coding projects in real time irrespective of your location is not of any importance. Among these, CodePen represents one of the platforms that is available with all the necessary features of coding and collaboration tools, communication features and file management. CodePen is the most common code-sharing platform among developers for prototyping and experimenting with code, and it is especially helpful for web development projects.

CodePen provides the users a platform to build „pens“, that consist of HTML, Javascript and CSS code. Users can then assign their pens to others and make them visible to everyone, who can also view and edit the code in real-time. CodePen uses the operational transformation technology to synchronize the code between users, hence all users see the same version of the code, even though the time of their joining the session is different. It removes a threat of conflicts and latency that supports the platform's usability as a decent tool for collaboration.

CoPen is also famous because of its community features that are consisting of a social feed, where users can follow each other and see their activity, plus forums for the purpose of asking questions and sharing knowledge. CodePen also has regular challenges and contests which are a good way for users to display their skills and compete with other people.

Codpen is a helpful tool that gets developers involved in real-time collaborations when it comes to coding projects. It's simple to use interface, scheduling technology, and social networking possibilities are among the main reasons why it is preferred, and particularly, among web developers.

V.6 CODEANYWHERE

Codeanywhere lets you code from anywhere with an internet link. It is a cloud IDE that lets you write, work with others, and run code from any gadget. It has cool

stuff like color-coding text, auto-fill, bug fixing, and file transfer tools. You can share your code for teamwork, and chat while you work. It speaks many code languages, so many code tasks can be done. With its cloud setup, you can change how much power you use anytime. Codeanywhere is a strong, handy tool for coders who want a quick and bendy space to write code.

V.7 KODING

Koding gives devs a cloud place to code together in real time. It lets you make and check your code in the cloud, and talk and work with others with special team tools. Koding has cool things like Git, text with colors, and handling lots of files at once. It also lets you have your own virtual machine, so you can set up your coding space how you like. There's even a market to share your stuff and find new tools and tips. Koding is strong and full of choices for any coder who wants to join in and make stuff.

CONCLUSION

Only a few platforms are available that let several people work together to edit code in real time. With our platform, two users can converse via audio and video chats in addition to writing and editing code at the same time. The WebRTC API has been put into practice to provide smooth audio and video communication. The difficulty that many computer science students encounter when asking for peer help with their programming is resolved by this platform. Rather than depending on

The platform makes collaboration easier by offering a single workspace where two people can collaborate on a piece of code while sharing code across many channels.

In addition, the platform facilitates more transparency and interactive cooperation while addressing complicated problems. Several points of view and input from various users can help solve problems more quickly. More collaboration options can be created in the future by expanding the platform to enable more than two users to work on a single piece of code. Private rooms can also be used to meet the needs of educational institutions that need a more private and controlled workspace. To attract people interested in

working on specific coding projects, public rooms with specific tags can be built. This will increase the platform's reach and possibility for collaboration.

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