

## **Problem Statement**

Title of the Study:

Development of a Real-Time Collaborative Online Integrated Development Environment

### **1. Introduction**

In recent years, software development, technical education, and recruitment processes have increasingly relied on collaborative programming practices. However, most collaboration is still carried out using traditional methods such as screen sharing, local Integrated Development Environments (IDEs), and asynchronous code sharing platforms. These approaches often fail to provide true real-time interaction, seamless synchronization, and secure execution environments. As a result, there is a growing need for a unified, browser-based system that enables real-time collaborative coding with integrated execution and validation capabilities.

### **2. Background of the Problem**

Collaborative programming is a critical component of modern software engineering, especially in academic institutions, remote interviews, and distributed development teams. Existing tools either focus on code editing without execution support or provide execution features without real-time collaboration. Additionally, differences in local system configurations, software dependencies, and operating environments frequently cause inconsistencies in code behavior. These limitations lead to inefficiencies, increased setup time, security concerns, and reduced productivity.

Furthermore, many current solutions lack fine-grained access control, real-time synchronization mechanisms, and secure sandboxing for code execution. This makes them unsuitable for academic evaluations, technical interviews, and instructional use cases where fairness, security, and consistency are essential.

### **3. Statement of the Problem**

Despite the availability of various coding platforms and communication tools, there is no comprehensive solution that effectively integrates real-time collaborative editing, secure code execution, and session-based access control within a single web-based environment. Existing systems either compromise on synchronization accuracy, execution safety, or usability. This gap results in fragmented workflows, reliance on multiple tools, and an increased risk of errors and security vulnerabilities. Therefore, there is a need to design and develop a real-time collaborative online IDE that addresses these challenges in a secure, efficient, and scalable manner.

#### **4. Objectives of the Study**

The objectives of this project are:

- To design a browser-based real-time collaborative coding environment.
- To enable synchronous code editing with minimal latency among multiple users.
- To provide secure and sandboxed code execution for supported programming languages.
- To ensure consistent execution results regardless of user device or configuration.
- To support academic, instructional, and interview-based coding sessions effectively.

#### **5. Significance of the Study**

This study is significant as it aims to improve the way collaborative programming activities are conducted in academic and professional settings. By providing a unified platform, the proposed system reduces dependency on local environments and multiple external tools. It enhances learning experiences, simplifies technical interviews, and promotes secure and efficient collaboration. The system also contributes to better evaluation standards and improved productivity in distributed development scenarios.

#### **6. Scope of the Problem**

The scope of this project is limited to the development of a real-time collaborative online IDE that supports JavaScript and Python programming languages. The system focuses on real-time code editing, execution, and session management within a web environment. It does not address long-term application hosting, complex build pipelines, or support for compiled languages beyond the defined scope.