**Article** **ECORFAN Journal-Republic of Colombia**
June, 2023 Vol.9 No.16 19-22

# Collaborative software project development with source code repository

# Desarrollo colaborativo de proyectos de software con repositorio de código fuente

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**DOI**: 10.35429/EJC.2023.16.9.19.22 Received April 18, 2023; Accepted June 30, 2023

**Abstract**

Working on projects in isolation presents significant limitations. The lack of interaction and collaboration among students hinders the learning of diverse approaches, limits the expansion of understanding on a subject, and can decrease students' commitment and interest. Additionally, the absence of interaction negatively affects the development of key skills for academic and professional success. In the field of software project development, having a centralized source code repository is essential. It facilitates collaboration among team members, allowing them to work on the same project, make changes, review code, and solve problems together. It provides tools and functionalities that improve coordination and version control, resulting in more efficient and higher quality development. In summary, this article highlights the importance of collaboration among students and the use of centralized source code repositories to facilitate interaction, knowledge sharing, and ensure the quality of work in both academic and professional settings. It promotes collaboration through group projects, team activities, and online platforms that facilitate the exchange of ideas

**Collaboration, Repository, Source Code**

**Resumen**

El trabajo de proyectos de manera aislada presenta limitaciones significativas. La falta de interacción y colaboración entre los estudiantes dificulta el aprendizaje de enfoques diversos, limita la ampliación de la comprensión sobre un tema y puede disminuir el compromiso e interés de los estudiantes. Además, la ausencia de interacción afecta negativamente el desarrollo de habilidades clave para el éxito académico y profesional. En el ámbito del desarrollo de proyectos de software, contar con un repositorio de código fuente centralizado es esencial en el desarrollo de proyectos de software. Facilita la colaboración entre los miembros del equipo, permitiendo trabajar en el mismo proyecto, realizar cambios, revisar el código y resolver problemas de manera conjunta. Proporciona herramientas y funcionalidades que mejoran la coordinación y el control de versiones, lo que resulta en un desarrollo más eficiente y de mayor calidad. En resumen, este articulo destaca la importancia de la colaboración entre estudiantes y el uso de repositorios de código fuente para facilitar la interacción, compartir conocimientos y asegurar la calidad del trabajo tanto en el ámbito académico como en el profesional, fomentando la colaboración a través de proyectos grupales, actividades en equipo y plataformas en línea que faciliten el intercambio de ideas.

**Colaboración, Repositorio, Código Fuente**

**Citation**: DURAN-BELMAN, Israel, MAGDALENO-ZAVALA, Juan Antonio and GALLARDO-ALVAREZ, Dennise Ivonne. Collaborative software project development with source code repository. ECORFAN Journal-Republic of Colombia. 2023. 9-16: 19-22

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## Introduction

A source code versioner, also known as a version control system, is a tool used in software development to manage and track changes made to a project's source code over time. The source code versioner allows developers to collaborate effectively on a project by allowing them to work in parallel on different branches or versions of the code, make changes without affecting the main version and merge those changes in an orderly and controlled manner.

It also makes it easy to track who made each change, when it was made and why it was made. By using a source code versioner, developers can access previous versions of the code, allowing them to revert changes if necessary, compare differences between versions, and resolve conflicts when two or more people have made changes to the same piece of code. There are several version control systems available, with Git being one of the most popular and widely used in the software development industry. Git allows both small and large projects to be managed efficiently, and has a wide range of features and tools to facilitate collaborative development and version management of source code.

Working on collaborative projects means that several people are involved in the development of a project, each contributing their knowledge and skills to achieve common goals. A version control system plays a key role in this type of work, as it allows for more effective and organized collaboration. Here are some features and benefits of using a version control system in collaborative projects:

1. Change management: the version control system records and stores every change made to the source code, making it easier to track changes and understand who made each change.

2. Parallel work: Developers can work on different branches or versions of the code simultaneously, without interfering with each other's work. Each person can make changes in his own branch and then merge them in a controlled and orderly manner.

3. Conflict resolution: When two or more people make changes to the same part of the code, there can be conflicts. The version control system helps to identify and resolve these conflicts efficiently, avoiding loss of work or code corruption.

4. Revert changes: In the event that a bug or unwanted change is introduced, the version control system allows for easy reverting to a previous version of the code. This is especially useful when problems are discovered later in the development process.

5. Remote collaboration: A version control system facilitates remote collaboration, as developers can access the source code from any location and make changes seamlessly. This is especially relevant in geographically distributed teams.

6. Feedback and communication: Version control systems often provide the ability to add comments to changes made, which helps maintain a clear record of decisions made and provides context to other team members.

Overall, a version control system improves efficiency, transparency and collaboration in projects by enabling developers to work together more effectively and achieve satisfactory results.

## Materials and Methods

For the present project, a problem was detected in the development of team projects in the CMMI course of the Computer Systems Engineering course of the Instituto Tecnológico Superior de Irapuato, and the objective was to implement the development of projects through a tool that would allow team work, but building individual modules, which would facilitate the student's learning in the programming area.

The following phases were followed for the development of the project:

ISSN-On line: 2539-1372


DURAN-BELMAN, Israel, MAGDALENO-ZAVALA, Juan Antonio and GALLARDO-ALVAREZ, Dennise Ivonne. Collaborative software project development with source code repository. ECORFAN Journal-Republic of Colombia. 2023

## Search for Tools

It is essential for any development team that wants to efficiently manage the version control of its source code, to have a development environment, it is essential to have a tool that allows tracking, coding and managing changes made to the code over time, facilitating collaboration, conflict resolution and implementation of new features in an orderly manner. GitHub is a web platform that provides a collaborative environment for software development using the Git version control system.

**Figure 1** GitHub repository

Repositories: A repository on GitHub is a space where a project's files and change history are stored. You can create repositories for your projects and collaborate with other developers on them. Repositories can be public (accessible to everyone) or private (accessible only to collaborators you invite).

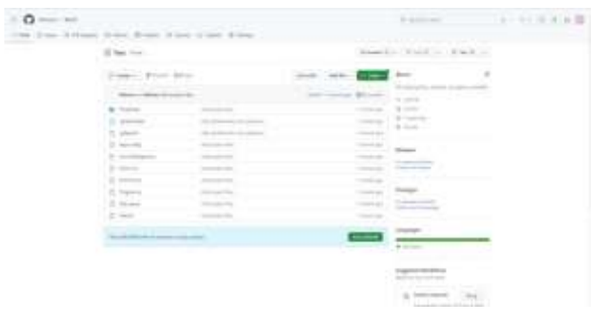

**Figure 2** Visual Studio Project/Solution on GitHub

## Tools configuration:

How to install and configure the code versioner in the development environment is taught. This may include software installation and initial user identity setup; it facilitates team collaboration. You can invite other developers to collaborate on your repository, assign tasks, review and comment on code, and keep a revision history to track changes and improvements.

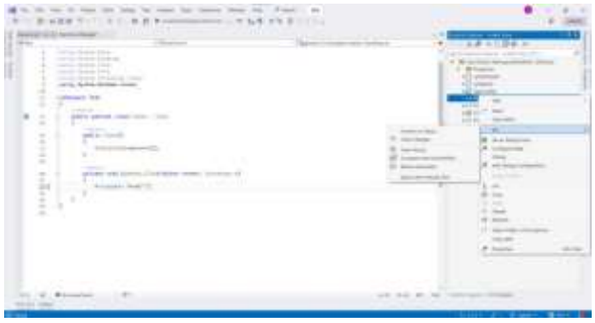

**Figure 3** Visual Studio code with GitHub configurations GitHub

## Project implementation:

The development of the project required the participation of eighth semester students, from the Integral Development Model subject, which has a total of 22 students and they were divided into three teams of four members and two teams of five. Each team was defined a specific role and a project which they had to carry out using GitHub and Visual Studio 2022. The project development time was contemplated for four months during which each team developed a different project.

The software project that the students should realize is based on the work of individual modules in which one member of the team serves as project leader and coordinates the progress according to the design postponed by the team.

It is worth mentioning that they must register to the github page and mount the project on the teacher's server, which monitors the progress in the time he wants.

This meant that the team members had to have constant communication and coordinate the progress of the project, respecting the times and forms that each one of them is using, forcing them to work as a team to avoid delays and unfinished forms.

## Results

According to the projects and the time delivered, the following data were obtained:

– 60% of the teams (3 out of 5 teams) finished in time and form, verifying the information in the github platform with the progress of each project and its respective team.

ISSN-On line: 2539-1372

– 100% of the teams stated that it is complex to agree on the different activities to be developed when there is only one platform to deliver the project, which requires constant communication with the members, otherwise it could affect the development of the project.

– The two teams that did not deliver the project (40%), in addition to the lack of communication, expressed that they had problems with the computer equipment, which hindered the desired progress.

According to the results obtained by the work teams, it has been concluded that it is essential for students to become familiar with tools such as GitHub. These tools are of vital importance to facilitate the integration of work teams, since, in the field of software development, version control systems are used for each project carried out.

## Conclusions

It is determined that continuous training is required to learn how to configure and adapt projects according to the needs of each team. Regarding teamwork, it has been observed that, when facing this type of projects, students leave their comfort zone and are forced to maintain constant communication in order to move forward according to the initial plans. This differs from the usual practice where each person develops a module separately and they merge at the end.

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ISSN-On line: 2539-1372


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